

**A CROSS-SECTIONAL STUDY ON THE PREVALENCE  
OF HYPERTENSION AMONG SCHOOL STUDENTS  
AGED 14 TO 17 YEARS IN RURAL AREAS OF  
KANCHEEPURAM DISTRICT, TAMIL NADU, 2011**

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## **CERTIFICATE**

This is to certify that the dissertation titled “**A CROSS-SECTIONAL STUDY ON THE PREVALENCE OF HYPERTENSION AMONG SCHOOL STUDENTS AGED 14 TO 17 YEARS IN RURAL AREAS OF KANCHEEPURAM DISTRICT, TAMIL NADU, 2011**” is a bonafide work carried out by **Dr. D. RAJA**, Post Graduate student in the Institute of Community Medicine, Madras Medical College, under my supervision and guidance towards partial fulfillment of the requirements for the degree of M.D. Branch XV Community Medicine and is being submitted to The Tamil Nadu Dr.M.G.R. Medical University, Chennai.

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## **ABBREVIATIONS**

BMI	-	Body Mass Index
BP	-	Blood Pressure
CAD	-	Coronary Artery Disease
CARDIA	-	Coronary Artery Risk Development In Young Adults
CIMT	-	Carotid Intima Media Thickness
CKD	-	Chronic Kidney Disease
CVD	-	Cardio Vascular Disease
CI	-	Confidence Interval
DALY	-	Disability Adjusted Life Years
DASH	-	Dietary Approaches to Stop Hypertension
DBP	-	Diastolic Blood Pressure
df	-	Degree of Freedom
DM	-	Diabetes Mellitus
GBD	-	Global Burden of Disease
ISH	-	International Society of Hypertension
JNC	-	Joint National Committee
LDL	-	Low Density Lipoprotein
LVH	-	Left Ventricular Hypertrophy
NHBPEP	-	National High Blood Pressure Education Program
NS	-	Not Significant
OR	-	Odd's Ratio
SBP	-	Systolic Blood Pressure
SD	-	Standard Deviation
SPSS	-	Statistical Package for Social Sciences
SS	-	Statistically Significant
WHO	-	World Health Organization

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# INTRODUCTION

# **1. INTRODUCTION**

Hypertension is an iceberg disease with high morbidity & mortality and is a silent threat to the health of the people both in developed and developing countries. It plays a major role in the development of ischemic heart disease, cerebrovascular disease, cardiac and renal failure. Unlike most of the diseases hypertension mostly goes unnoticed before the development of complications. Around 1 billion people in the world were hypertensives in the year 2000 and this is expected to increase to 1.56 billion by 2025.<sup>1</sup>

Worldwide, 7.6 million premature deaths (about 13.5% of the global total) and 92 million DALYs (6.0% of the global total) were attributed to high blood pressure. About 54% of all stroke and 47% of all coronary artery disease are attributable to hypertension.<sup>2</sup> Globally, the overall prevalence of raised blood pressure in adults aged 25 and over was around 40% in 2008. The prevalence of raised blood pressure was highest in the WHO African Region, where it was 46% for males and females combined.<sup>3</sup>

## **Indian Scenario**

Studies show that hypertension is prevalent in 20-40% urban and 12-17% rural population in India. Gupta R from Jaipur, through his series of epidemiological studies carried out during 1994, 2001 and 2003 found a rising prevalence of hypertension (30%, 36%, and 51% respectively among males and 34%, 38% and 51% among females).<sup>4</sup> Various hypotheses have been put forward to explain this rising trend and among these, consequences of urbanization such as changes in life style pattern, diet and stress have been implicated.<sup>5</sup>

## **Adolescent Hypertension**

Hypertension emerges from a complex interplay of genetic, environmental and behavioural factors. Owing to the hereditary component of hypertension, the disorder is considered to have its origin in the childhood. Children and adolescents with high BP tend to maintain those levels of BP in adulthood.<sup>6</sup> As the symptoms of childhood and adolescent hypertension are largely nonspecific, most children with hypertension are likely to be undiagnosed.

Worldwide prevalence of Hypertension among adolescents is not known. The prevalence of hypertension among children and adolescents in recently done studies in western countries ranged from 7% to 19%.<sup>7</sup> The pattern of BP over time, referred to as tracking of BP has been demonstrated by various studies including Bogalusa heart study.<sup>8</sup> In the Muscatine study Lauer et al. identified that 24% of young adults whose BP ever exceeded 90th percentile for that age, had adult BP greater than 90th percentile, a percentage that is 2.4 times higher than what was expected.<sup>9</sup>

Adolescents constitute around 21 % among the Indian population. Various studies in India have shown a wide range in prevalence of Hypertension among children and adolescents (1-11.5%). Chadha et al. has reported a prevalence of 11.5% among school children (5-16yrs) in Delhi.<sup>10</sup>

Hypertension in the young is increasing in prevalence, with much of the increase being fuelled by the increase in obesity among them. This association between obesity and hypertension in children and adolescents has been reported in number of studies among varied ethnic and racial groups, with constantly all studies finding greater prevalence of hypertension in obese children compared with the non obese.

According to a study by Miria Suzana Burgos et. al. in Brazil overweight and obesity account for 40.7% (hypertension) for SBP and 26.4% (hypertension) for DBP.<sup>11</sup> Sharma et al in Shimla, shows that rates of elevated blood pressure (prehypertension and hypertension) were significantly higher (46.5% vs. 17%,  $P<0.001$ ) among those with high BMI (overweight and obese) compared to those with normal BMI.<sup>12</sup> Apart from BMI factors that have an influence on BP are hereditary effects, stress, race and diet (mainly sodium). Various studies indicate a high positive correlation between family history and BP. Lefebvre et al. has reported a strong relationship between parental history of Hypertension before 60 yrs of age and offspring's hypertension.<sup>13</sup>

Apart from progression of hypertension into adult life, there are other complications of childhood and adolescent hypertension. Left ventricular hypertrophy has been documented in a significant proportion of hypertensive children and adolescents. Mc Niece et al. repeatedly demonstrated the correlation between high BP and LVH.<sup>14</sup> Increased carotid intimal thickness as a result of childhood hypertension has been reported by various studies (Vos et al).<sup>15</sup> Impaired cognitive function has also been reported. Most or all BP-related risks appear to be reversible within a few years with inexpensive interventions. Since it is well established that blood pressure during childhood and adolescence is an established predictor of adult blood pressure, which in turn increases mortality from Cardiovascular, Cerebrovascular and other complications, clearly underscores the importance of studying hypertension among them.

This study was planned to find out the prevalence of hypertension among adolescents in rural areas and also to identify the risk factors of hypertension among them.

# OBJECTIVES

## **2. OBJECTIVES**

- ❖ To assess the prevalence of hypertension among school students aged 14 to 17 years in rural areas of Kancheepuram district.
- ❖ To identify the risk factors for hypertension such as overweight & obesity, family history, diet pattern and physical activity among the study population.

# **JUSTIFICATION**

### **3. JUSTIFICATION**

- Hypertension is a major health problem worldwide and the prevalence of which is expected to be 1.56 billion by 2025.
- Hypertension plays a major role in the causation of Ischemic Heart Disease, Cerebrovascular, Cardiac & Renal failure and it tops the list of NCD risk factors which contribute to mortality and disease burden in India.
- Hypertension is known to have its origin in childhood & adolescence and those with high BP tend to maintain those levels of BP in adulthood.
- Hypertension among adolescents if diagnosed and managed early can lead to considerable decrease in morbidity and mortality from hypertension related complications during adulthood.
- Most of the studies related to adolescent hypertension were done in Northern part of India and there are few studies in southern part of India.
- There is paucity of data on the prevalence of hypertension among adolescents in rural areas of Tamil Nadu.

Hence, this study was undertaken to find out the prevalence of hypertension and its risk factors among adolescent population.



# **REVIEW OF LITERATURE**

## **4. REVIEW OF LITERATURE**

### **4.1 Hypertension**

Hypertension is the commonest cardiovascular disorder, posing a major public health challenge to population in socio economic and epidemiological transition.<sup>16</sup> The relationship between Blood pressure and CVD events is continuous, consistent and independent of other risk factors. The presence of additional risk factors compounds the risk from hypertension. According to GBD survey reports, hypertension tops the list of NCD risk factors which contribute to mortality and disease burden India.<sup>2</sup>

#### **4.1.1 Definition of Blood Pressure**

The term ‘Blood Pressure’ refers to arterial blood pressure. Arterial blood pressure is defined as the lateral pressure exerted on the walls of the artery by the flowing column of blood within the vessel. Blood pressure is conventionally expressed in terms of millimetres of mercury, although the internationally accepted unit is in terms of kilo Pascal.<sup>17</sup>

#### **4.1.2 Definition of Hypertension**

Hypertension is an arbitrary term used to delineate a dividing line above which the benefit-risk ratio from intervention becomes acceptable.

According to Sir George Pickering (1972) “There is no dividing line. The relationship between arterial pressure and mortality is quantitative; the higher the pressure, the worse the prognosis.” As stated by Rose (1980): “The operational definition of hypertension is the level at which the benefits... of action exceed those of inaction”.<sup>17</sup>

### 4.1.3 OPERATIONAL CLASSIFICATIONS

According to the 7<sup>TH</sup> JNC report on Prevention, Detection, Evaluation and Treatment of High Blood Pressure classification of Blood Pressure is as follows<sup>18</sup>:

**Table 1: JNC 7 Blood Pressure classification**

<b>CLASSIFICATION</b>	<b>SBP (mmHg)</b>	<b>DBP (mmHg)</b>
<b>Normal</b>	<120	and <80
<b>Prehypertension</b>	120-139	or 80-89
<b>Stage 1 hypertension</b>	140-159	or 90-99
<b>Stage 2 hypertension</b>	≥160	or ≥100

Table 2 shows another classification by World Health Organization (WHO)/ International Society of Hypertension (ISH) <sup>19</sup>,

**Table 2: WHO and ISH classification of Hypertension**

<b>HYPERTENSION</b>	<b>SBP (mmHg)</b>	<b>DBP (mmHg)</b>
<b>Grade 1</b>	140-159	90-99
<b>Grade 2</b>	160-179	100-109
<b>Grade 3</b>	≥180	≥110

According to European Society of Hypertension (2007 guidelines) <sup>20</sup> blood pressure is classified as Grade 1, 2 and 3 hypertension and in addition it has a separate category for Isolated Systolic Hypertension.

#### 4.1.4 CAUSES OF HYPERTENSION <sup>21</sup>

##### (a) Essential hypertension

In more than 95% of cases a specific underlying cause of hypertension cannot be found. Such patients are said to have essential or primary or idiopathic hypertension. The pathogenesis is not clearly known.

##### (b) Secondary Hypertension

In about 5% of cases hypertension can be shown to be a consequence of a specific disease or abnormality leading to sodium retention or peripheral vasoconstriction.

1. **Alcohol**
2. **Pregnancy** (pre-eclampsia)
3. **Renal disease-** Renal vascular disease, Renal parenchymal disease, etc.
4. **Endocrine disease** – Pheochromocytoma, Cushing's syndrome, Conn's syndrome, Hyperparathyroidism, Acromegaly and Thyrotoxicosis
5. **Drugs** - Oral contraceptives with oestrogens, anabolic steroids, corticosteroids, etc.

#### 4.1.5 RISK FACTORS OF HYPERTENSION <sup>16</sup>

**Table 3: Risk factors of Hypertension**

Non-modifiable risk factors	Modifiable risk factors
Age	Obesity      Salt intake
Sex	Saturated fat      Dietary fibre
Genetic factors	Alcohol      Environmental stress
Ethnicity	Physical activity

#### 4.1.6 COMPLICATIONS OF HYPERTENSION <sup>21</sup>

The adverse effects of hypertension mainly involve the blood vessels, the central nervous system, the retina, the heart and the kidneys.

**Table 4: Complications of Hypertension**

<b>Blood vessels</b>	Larger arteries – thickening of internal elastic lamina  Smaller arteries – hyaline arteriosclerosis  Widespread atheroma – coronary or cerebrovascular disease
<b>Central nervous system</b>	Stroke  Transient ischemic attacks  Hypertensive encephalopathy
<b>Retina</b>	Arteriolar thickening  Retinal ischemia  Papilloedema
<b>Heart</b>	Coronary artery disease  LVH  Atrial fibrillation  Left ventricular failure
<b>Kidneys</b>	Proteinuria  Progressive renal failure
<b>Malignant hypertension</b>	Intravascular thrombosis  Left ventricular failure

## 4.2 HYPERTENSION AMONG ADOLESCENTS

While high blood pressure is commonly thought of as an "adult problem", adolescents and even younger children can develop high blood pressure.

### 4.2.1 CLASSIFICATION OF HYPERTENSION IN ADOLESCENTS

According to the Fourth report on the diagnosis, evaluation and treatment of high blood pressure in children and adolescents by National High Blood Pressure Education Program Working Group<sup>22</sup> blood pressure is classified as follows,

**Table 5: Blood Pressure classification in Children and Adolescents**

Blood Pressure Classification	Systolic or Diastolic BP Percentile
Normal	<90 <sup>th</sup> Percentile
Prehypertension	90 <sup>th</sup> -95 <sup>th</sup> ; or if BP is >120/80 mmHg even if <90 <sup>th</sup>
Hypertension	>95 <sup>th</sup> Percentile

### 4.2.2 PREVALENCE OF HYPERTENSION IN ADOLESCENTS- GLOBAL SCENARIO

It has been considered that hypertension is uncommon during adolescence. Global prevalence of the disease is not known due to differences in the definition of high BP and measurement of BP.<sup>23</sup>

Jaddau HY et al. has reported 3.7% prevalence of definite hypertension in a study conducted among 7260 adolescent military school students in Jordan in which girls had a lower prevalence (3.1%).<sup>24</sup>

In a cohort study conducted by Hansen ML et al. among 14187 school children in outpatient clinics in northeast Ohio between 1999 and 2006 has reported 3.6% of hypertension and 3.4% of prehypertension.<sup>25</sup>

In a cross sectional study conducted among 1041 high school students by Nur N et al in Sivas province of Turkey has identified 4.4% of the students were having hypertension. Hypertension was prevalent among 5.4% of male and 3.0% of the female students.<sup>26</sup>

Lurbe et al in their study on prevalence of masked hypertension reported 7.6% of hypertension and 0.8% of sustained hypertension among 592 youths who attended pediatric clinic in a hospital of University of Valencia.<sup>27</sup>

Abolfotouh et al. reported 5.7% & 4% of hypertension and prehypertension among 1500 school students in Alexandria city, Egypt. There was no sex difference in prevalence of hypertension among the study population.<sup>7</sup>

Silva MAM et al. found out 7.7% prevalence of hypertension among children and adolescents in public and private schools in the city of Maceio. Among males the prevalence was 8.6% whereas among females it was 7.1 % .<sup>28</sup>

Sorof MJ et al. reported the prevalence of elevated BP on first, second and third screenings to be 19.4%, 9.5% and 4.5% respectively among 5102 students in 8 Houston public schools.<sup>29</sup>

In a study conducted by Vlajinac et al. in Belgrade the prevalence of hypertension was found to be 4.7% in boys and 5.3% in girls. Mean SBP and DBP was 113.4/70.3 mmHg in boys and 114.6/71.1 mmHg in girls.<sup>30</sup>

### 4.2.3 PREVALENCE IN INDIA

Since there is no established standard for hypertension among adolescents in India, studies have reported a wide range in the prevalence of hypertension in children and adolescents from 1% to 11.5%.

Durrani AM et al. reported that hypertension was 9.4% prevalent among school children in Aligarh. Blood pressure in both the sexes was found to be correlated with anthropometric indices such as height and weight.<sup>31</sup> In a cross sectional study among urban Asian Indian adolescents by Goel R et al. the prevalence of hypertension was found to be 6.4%, of which 2.7% had isolated systolic, 2% had isolated diastolic and 1.7% had both systolic and diastolic hypertension.<sup>32</sup>

Soudarssanane MB et al. has reported that hypertension was prevalent among 8.5% of adolescents in urban area of Pondicherry. Prevalence was higher among males (9.4%) when compared to females (7.5%). 38.6% had isolated systolic hypertension, 40.4% had isolated diastolic hypertension and 21 % had both systolic and diastolic hypertension.<sup>33</sup>

Verma M et al. found out the prevalence of hypertension as 2.8% on first screening and on subsequent screening of the same group after 6 months and 9 months reported a fall in the prevalence (1.3% and 1.1% respectively). This fall in hypertension prevalence was statistically significant ( $P < 0.01$ ).<sup>34</sup> Anjana et al. reported 7.5% prevalence of hypertension among 1000 school children in Amritsar district of Punjab. The mean values of SBP and DBP increased with age.<sup>35</sup> Taksande A et al. in their study on distribution of BP in school children in a rural district of Maharashtra reported 5.75% prevalence of hypertension among them (3.25% systolic and 2.79% diastolic hypertension).<sup>36</sup>



Sharma A et al. found out 5.9% of hypertension and 12.3% of pre hypertension among adolescent school children in Shimla. The prevalence of hypertension among rural students was found to be less than urban students (4.3% vs. 7.1%). But the prevalence of prehypertension was high among rural students than urban students (14.3% vs. 9.8%).<sup>12</sup> Khan MI et al in a study conducted in Ahmedabad found that 9.78% of the adolescent boys were hypertensive. Higher prevalence was seen among 19 year old boys (21.7%). Mean SBP was reported as 109.6mmHg and mean DBP was 69.3mmHg.<sup>37</sup>

#### 4.2.4 ETIOLOGY OF HYPERTENSION AMONG ADOLESCENTS

Among pre adolescent children, primary or essential hypertension is exceedingly rare. In these age groups secondary hypertension is more common (Table 6). Among the secondary causes of hypertension renal diseases tops the list.<sup>17</sup>

**Table 6: Estimated Causes of Hypertension in Children and Adolescents**

TYPE	CHILDREN	ADOLESCENTS
<b>Primary / Essential</b>	<b>15-30%</b>	<b>85-95%</b>
<b>Secondary Hypertension</b>	<b>70-85%</b>	<b>5-15%</b>
▪ Renal parenchymal	60-70%	
▪ Renovascular	5-10%	
▪ Endocrine	3-5%	
▪ Aortic coarctation	10-20%	

In adolescents, however, essential hypertension accounts for majority of the cases (85-95%). The secondary causes of hypertension are comparable to the list of causes in younger children. Primary hypertension in adolescents is mostly characterized by isolated systolic hypertension.<sup>38</sup> On the other hand diastolic hypertension most often accompanies secondary causes of hypertension.

Certain groups of children are at an increased risk of developing hypertension in childhood. Munger et al. reported that children of hypertensive parents are at an increased risk of developing hypertension in young age.<sup>39</sup> Buonomo E et al. found that overweight and a parental history of obesity are predictive and possibly causal factors for essential hypertension.<sup>40</sup>

#### **4.2.5 FACTORS INFLUENCING HYPERTENSION AMONG ADOLESCENTS<sup>17</sup>**

There are various factors which play a role in hypertension among adolescents. They are shown in the following table,

**Table 7: Factors that influence Hypertension among Adolescents**

<b>Genetic</b>	Ethnicity Obesity Increased salt sensitivity	Parental and sibling BP levels Autonomic abnormalities
<b>Environmental</b>	Birth weight Neonatal weight gain	Socio economic status
<b>Mixed genetic and Environmental</b>	Height Body mass Sodium and other nutrient intakes	Weight Pulse rate Somatic growth and sexual maturation

#### 4.2.6 Obesity and Hypertension

The prevalence of obesity in the children and adolescents has increased markedly in the last two decades. Primary hypertension in the adolescents is becoming increasingly common in association with obesity.

Moore WE et al. in their study named Healthy Kids Project reported 28% of overweight among 769 students from Anadarco student population. They found that BMI more than 95<sup>th</sup> percentile was strongly associated with elevated blood pressure (RR-3.8; 95%CI: 2.6-5.4).<sup>41</sup>

Paradis G et al. found that BMI was associated with SBP and DBP consistently in all the ages and both the genders. BMI was 4-6 kg/m<sup>2</sup> higher among those with SBP >95<sup>th</sup> percentile.<sup>42</sup>

In a study conducted in China by He Q et al. hypertension was seen in 19.4% of obese children and 7% in non obese children with  $P < 0.0001$ . Both SBP and DBP were found to be significantly associated with BMI values ( $P < 0.05$ ) and increase in one unit of BMI was associated with an increase of 0.56mmHg SBP and 0.54mmHg DBP.<sup>43</sup> Burgos et al. conducted a study among 1666 school students in Brazil and found that 26.7% of them were overweight or obese and 35.9% had body fat percentage moderately high. Hypertension was prevalent among 12.1% of students and there was a significant correlation with BMI ( $P < 0.05$ ).<sup>11</sup>

The Bogalusa heart study on Body fat patterning and BP conducted on 5224 children and young adults by Shear et al found that in children and adolescents central body fat (sub scapular fat) was correlated with high blood pressure. They also found that the peripheral fat has no correlation with blood pressure.<sup>44</sup>

Itagi V et al. in their study done in Karnataka measured BP and other anthropometric data twice during 2005-06 and 2007-08 respectively. Overweight increased from 4.9% to 6.5% among the students (OR: 1.36; 95% CI: 1.25-1.47). Hypertension prevalence was high among overweight when compared to those with normal BMI.<sup>45</sup> Raj M et al. has reported a rising trend of obesity among school children in Ernakulam district of Kerala. Hypertension was found among 17.34% of overweight children vs. 10.1% among other students ( $P<0.001$ ).<sup>46</sup>

#### **4.2.7 Family History and Hypertension**

Recently published studies have demonstrated that large numbers of adolescents with essential hypertension have a positive family history of hypertension in a parent.

Falkner F et al. followed up adolescents with BP between 90 to 95<sup>th</sup> percentile. They found that many of them developed hypertension and those who developed hypertension had a strong family history of Hypertension.<sup>47</sup>

A study done in Punjab among 2560 school children by Verma M et al. has reported that family history of hypertension was significantly associated with elevated blood pressure ( $P<0.01$ ).<sup>48</sup> Goel R et al. reported that family history of hypertension has significant association with diastolic hypertension (OR 2.21; 95% CI: 1.13 to 4.33) among urban Asian Indian adolescents.<sup>32</sup> Sharma et al. reported that the prevalence of hypertension was significantly higher among those children with positive family history of hypertension when compared to other children (8.6% vs. 5%;  $P=0.04$ ). Khan MI et al. in their study on hypertension and its risk factors among adolescent boys reported that family history of hypertension and hypertension among boys were having significant association ( $P<0.001$ ).<sup>37</sup>

#### **4.2.8 Diet Pattern and Hypertension**

Role of diet in adolescent hypertension is mostly restricted to sodium intake. Role of calcium and potassium in adolescent hypertension is being explored.

Khan MI et al. reported no association between hypertension and risk factors such as added salt and junk foods.<sup>37</sup> Soudarssanane MB et al has also reported that there was no significant association between diet (vegetarian or non vegetarian) and hypertension.<sup>33</sup>

#### **4.2.9 Salt Intake**

In a meta analysis done by He FJ and MacGregor GA on the effect of salt on BP in children, it was found that reduction in salt intake by 42% resulted in significant reductions in blood pressure: systolic-1.17 mmHg (95%CI: -1.78 to- 0.56 mmHg; P<0.001); diastolic-1.29 mmHg (95%CI: -1.94 to-0.65 mmHg; P<0.0001).<sup>49</sup>

Soudarssanane MB et al has reported a significant association between salt intake and hypertension among male adolescents in urban area of Pondicherry. The association was confirmed by the nested case control study (P=0.02).<sup>33</sup>

#### **4.2.10 Physical Activity and Hypertension**

Parker ED et al. in their CARDIA study done among 3993 participants on physical activity and incident hypertension on 15 years follow up reported 634 cases of incident hypertension. Those with more physical activity had a less risk of incident hypertension than the less physical activity group (Hazard rate ratio=0.83;95% CI:0.73-0.93).<sup>50</sup>

### 4.3 CONSEQUENCES OF ADOLESCENT HYPERTENSION

The most important consequence of elevated BP among children and adolescents is that it predicts the development of adult hypertension. If BP levels of individuals are followed up over a period of years from childhood to adult life, then those individuals whose BP were initially high, would continue in the same track. This phenomenon of persistence of rank order of BP is called as “tracking”.<sup>16</sup> Not only BP levels but also the other known cardio vascular risk factors can be measured in the young and then related to the subsequent development of cardiovascular manifestations in adulthood.<sup>17</sup>

The long term sequelae of adult hypertension such as myocardial infarction and stroke do not occur in children. But it has been proved that persistent elevation of BP in children and adolescents can produce other target organ damages such as left ventricular hypertrophy, etc.

The consequences of adolescent hypertension can be classified as given in the following table,

**Table 8: Consequences of Adolescent Hypertension**

<ol style="list-style-type: none"><li><b>1. Hypertension during adulthood (Tracking of BP)</b></li><li><b>2. Increased Cardio vascular mortality in adulthood</b></li><li><b>3. Hypertensive Target Organ damage in the young</b><ul style="list-style-type: none"><li>▪ Left ventricular hypertrophy</li><li>▪ Increased carotid intima media thickness</li><li>▪ Impaired cognitive function</li><li>▪ Retinal artery narrowing</li></ul></li></ol>
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### **4.3.1 HYPERTENSION DURING ADULTHOOD**

#### **Blood Pressure tracking**

It is increasingly clear that adult hypertension have their origin in childhood itself. As already described “Tracking” is persistence of rank order of BP from childhood to adult stage. Many studies have been done to support this phenomenon.

In the Bogalusa cohort, 40% of those with systolic BP and 37% of those with diastolic BP above the 80th percentile at baseline continued to have BP above the 80th percentile 15 years later.<sup>8</sup>

Zinner SH et al found a significant relation between BP readings taken initially and follow up readings taken after 4 years. ( $P < 0.001$  for SBP and 0.14,  $P = 0.001$  for DBP). This data proves that stratification of BP into peer groups occurs in childhood itself.<sup>51</sup>

Soundarssanane MB et al. in their study on tracking of BP among adolescents in Pondicherry found that there was no significant shift of individuals from one cut off to other proving the tracking phenomenon. 54.5% of those below 5<sup>th</sup> percentile, 93.6% of subjects between 5<sup>th</sup> and 95<sup>th</sup> percentile and 72% of those above 95<sup>th</sup> percentile stayed in the same cut offs for SBP. The corresponding values for DBP were 46.2%, 92.2% and 74.1%.<sup>52</sup>

### **4.3.2 INCREASED CARDIOVASCULAR DISEASE IN ADULTHOOD**

As of now there are no clear data on relationship between hypertension during young age and cardio vascular morbidity and mortality in adult life. But studies have shown that BP and cardio vascular risk factors in childhood predict the subsequent presence of Carotid intima-media thickness and arterial stiffness, both of which are accepted markers of atherosclerosis.<sup>17</sup>

In the Cardiovascular Risk in Young Finns study, Juonala M et al. studied the relationship between childhood BP and endothelial dependent brachial flow mediated dilation in adulthood. They reported an inverse relationship between SBP among male adolescents and adulthood flow mediated dilation.<sup>53</sup>

In addition studies have demonstrated that children with hypertension are at increased risk of developing metabolic syndrome during adulthood which is an important predictor of cardiovascular morbidity.

#### **4.3.3 HYPERTENSIVE TARGET ORGAN DAMAGE IN ADOLESCENTS**

##### **(a) Left ventricular hypertrophy**

Among the hypertensive children and adolescents the prevalence of LVH was found to be between 10-38% in various studies. This difference occurs due to variation in echo cardio graphic protocol.

Sorof M J et al. in their comparative study between hypertensive children identified by school based screening and referred cases found that the prevalence of LVH was 37% among them. Referral subjects had more left ventricular mass index.<sup>54</sup>

McNiece K L et al. found that among hypertensive subjects those with stage 2 hypertension have increased odds for LVH. And the risk for LVH was similar among subjects with stage 1 and masked hypertension whereas the risk was same for those with white coat hypertension and normal subjects.<sup>14</sup>

##### **(b) Carotid intimal thickening**

Atherosclerosis begins in childhood and the common carotid artery intima media thickness is a marker of pre clinical atherosclerosis. Carotid intima-media thickness has become a marker of hypertensive vascular damage.



In a prospective cohort study conducted by Raitakari OT et al. 2229 participants were examined during young age (3-18 yrs) and re examined 21 years later. Intimal medial thickness has showed significant association with childhood SBP ( $P<0.001$ ), BMI ( $P=0.007$ ) and LDL cholesterol.<sup>55</sup>

Lande MB et al. in their matched case control study found that the median carotid intima media thickness in hypertensives was greater than controls (0.67vs 0.63 mm;  $P=0.045$ ).<sup>56</sup>

#### **(c) Impaired cognitive function**

Recently, impaired cognitive function has been described as one of the target organ damage due to hypertension in the children and adolescents. This finding requires confirmation, but adds value to the recommendation of starting anti hypertensive therapy in children with persistently elevated BP.

Lande MB et al. compared the cognitive scores of children with elevated BP and normal BP. They found that children with elevated SBP had lower scores for digit span ( $P=0.01$ ), lock design ( $P=0.03$ ) and mathematics ( $P=0.01$ ). Children with elevated DBP had lower scores on block design ( $P=0.01$ ).<sup>57</sup>

#### **(d) Retinal artery narrowing**

In a population based study conducted in two countries- Australia and Singapore involving 1952 students by Mitchell P et al. found that children in the higher quartiles of BP were having narrow retinal arterioles than those with normal BP. They reported that for every 10 mmHg increase in SBP there was narrowing of retinal arterioles by  $2.08\mu\text{m}$ .<sup>58</sup>

## **4.4 DIAGNOSIS OF HYPERTENSION**

### **4.4.1 CONFIRMATION OF HYPERTENSION**

The most important step in evaluating an adolescent with elevated blood pressure is to confirm that the BP is being measured correctly.<sup>17</sup>

#### **4.4.1.1 Variation in Blood Pressure measurement**

Accurate measurements are needed so as to compare between individuals. The adverse consequences of incorrect measurement are obvious: the person may be wrongly labelled as hypertensive or non-hypertensive. This variation in BP measurement can occur due to following variations

1. **Observer variation-** Due to differences in the interpretation of Korotkoff's sounds
2. **Instrumental error-** There may be defects in the measuring device such as leakage of valve, inappropriate cuff size
3. **Subject variation-** Can occur due to fear, anxiety and varied position of the person<sup>16</sup>

#### **4.4.1.2 Recording of Blood Pressure**

Blood pressure can be measured by the following techniques:

1. Using sphygmomanometer
2. Oscillometric method
3. Finger cuff method of Penaz
4. Ultrasonography
5. Automated devices

#### 4.4.1.3 Sphygmomanometer

There are three types of sphygmomanometers namely- Mercury, Aneroid and Hybrid types of which mercury sphygmomanometer is commonly used. In this method the brachial artery is occluded by a cuff around the upper arm and inflated above systolic pressure. On gradual deflation, pulsatile blood flow occurs. It is accompanied by korotkoff's sounds audible through stethoscope held over the artery below the cuff.

The sounds have been classified into 5 phases: Phase I - appearance of clear tapping sounds corresponding to the appearance of a palpable pulse; Phase II - sounds become softer and longer; Phase III - sounds become crisper and louder; Phase IV - sounds become muffled and softer; and Phase V - sounds disappear completely. These sounds are thought to originate from combination of turbulent blood flow and oscillations of the arterial wall.

#### 4.4.1.4 Guidelines for Measurement of Blood Pressure

Techniques for manual BP measurement given by the American Heart Association are followed in children and adolescents.

**(i) Patient conditions:**

**Posture** – The patient should be asked to remove all clothing that covers the location of cuff placement. The individual should be comfortably seated, with the legs uncrossed and the back and arm supported, such that the middle of the cuff on the right upper arm is at the level of the right atrium. The individual is instructed to relax and not to talk during the measurement procedure. Ideally 5 minutes should elapse before first measurement.

**Circumstances:**      Avoid caffeine or smoking 30 min before measurement.  
                                 A quiet and warm setting.

**(ii) Equipment:**

**Cuff size**

- The bladder should encircle at least 80% of the circumference and cover two thirds of the length of the arm
- The recommended cuff sizes are:

**Table 9: Bladder cuff sizes for different age groups**

<b>Age Range</b>	<b>Width (cm)</b>	<b>Length (cm)</b>	<b>Maximum Arm Circumference (cm)</b>
<b>Newborn</b>	4	8	10
<b>Infant</b>	6	12	15
<b>Child</b>	9	18	22
<b>Small adult</b>	10	24	26
<b>Adult</b>	13	30	34
<b>Large adult</b>	16	38	44
<b>Thigh</b>	20	42	52

**Stethoscope** -Bell of the stethoscope to be used and avoid excess pressure

**(iii) Technique:**

- Take at least two readings, separated by as much time as is practical; if readings vary >5 mm Hg, take additional readings until two are close
- Inflate the bladder quickly to a pressure 20 mm Hg above the SBP, recognized by the disappearance of radial pulse, to avoid an auscultatory gap and deflate the bladder slowly. Record the Korotkoff phase I (appearance) and phase V (disappearance)<sup>17</sup>.

#### **4.4.1.5 Finger cuff method of Penaz**

In this method arterial pulsation in a finger is detected by a photoplethysmograph under a pressure cuff. The oscillations of pressure in the cuff are measured and have been found to resemble the intra-arterial pressure wave in most subjects.<sup>17</sup>

#### **4.4.1.6 Ultrasonography**

This technique uses an ultrasound transmitter and receiver placed over the brachial artery under a sphygmomanometer cuff. As the cuff is deflated, the movement of the arterial wall at systolic pressure causes a Doppler phase shift in the reflected ultrasound, and diastolic pressure is recorded as the point at which diminution of arterial motion occurs.<sup>17</sup>

#### **4.4.1.7 Oscillometric method**

It was shown that when the oscillations of pressure in a sphygmomanometer cuff are recorded during gradual deflation, the point of maximal oscillation corresponds to the mean intra-arterial pressure.<sup>59</sup>

#### **4.4.1.8 Automated devices**

Electronic devices are increasingly being utilized in clinics and hospitals. Almost all of the newer electronic devices are based on oscillometry, which detects initial (systolic) and maximal (mean arterial pressure) oscillations in the brachial artery and calculates the diastolic BP based on proprietary algorithms. In general, the readings obtained by auscultatory and oscillometric devices are closely correlated. These instruments eliminate the observer errors in manual auscultatory techniques such as terminal digit preference.<sup>17</sup>

#### 4.4.2 DIAGNOSTIC EVALUATION

Hypertension in children and adolescents is mostly asymptomatic.<sup>17</sup> Croix B et al. reported that headache, difficulty in initiating sleep and daytime tiredness as the common symptoms among adolescent hypertensives.<sup>60</sup> Symptoms like nosebleed, seizures, dizziness and syncope are rare. If these symptoms are seen in a young child, it may be a clue to secondary hypertension.<sup>17</sup> So, the diagnostic evaluation has to be tailored to the individual patient taking into account the age, sex, race, family history and level of hypertension.

1. **History:** Investigating an adolescent or child involves a detailed history taking. The history should aim to get information about possible secondary causes, target organ damage and other cardio vascular risk factors.
  - Look for urinary tract infections or any other renal disease
  - Ask for family history of hypertension
  - Ask for activity, dietary and other factors
  - Ask for alcohol, tobacco and substance abuse
  - Ask for intake of steroids or any alternative medicine
2. **Physical Examination:** A thorough examination is necessary, as it is the essential part of diagnosis.
  - Height, weight and BMI
  - BP in both arms and lower extremity
  - Femoral pulses and Carotid bruit
  - Fundi- Arteriolar narrowing, exudates, haemorrhages
  - Abdomen – bruits, hepato splenomegaly
  - Heart – rate, murmur, click, etc.
  - Extremities –Pulses, edema<sup>61</sup>

**3. Laboratory testing:** Some basic tests to be done in all adolescents with elevated BP.

**a. Screening tests:** To be done in all patients and it includes,

- Serum Electrolytes
- Blood urea and creatinine
- Urinalysis
- Complete blood count
- Lipid profile

**b. Specific lab tests:**

- Thyroid tests, if patient has symptoms of thyroid problem.
- Anti nuclear Antibody test and Erythrocyte Sedimentation Rate if symptoms like malar rash are seen.

**c. Echocardiogram:**

To be done in all confirmed cases of hypertension. This is done to detect LVH which is an indication for initiation drug therapy.

**d. Advanced testing:**

To be done to confirm secondary causes. For example, 24 hr proteinuria if proteinuria seen in urinalysis.

**e. Imaging studies:** Done only in specific circumstances.

- Chest x-ray if cardiac examination is abnormal
- Renal ultrasonography if urinalysis is abnormal
- Renal scans or angiography if needed.<sup>61</sup>

## **4.5 MANAGEMENT OF ADOLESCENT HYPERTENSION**

The management of hypertension among children and adolescents is largely empirical in contrast to management of hypertension in adults, which is guided by many number of clinical trials.<sup>62</sup> The decision as to whether a child to be started on drug therapy or not should be individualized.<sup>17</sup>

### **4.5.1 PREVENTION**

Adolescents who are at risk of developing hypertension at later life should be started on measures to prevent or minimize the effects of hypertension. Those who have the findings listed below are considered as at risk. They should be counselled about non pharmacologic approaches to maintain lower BP and should be monitored periodically:

- Those having prehypertension
- Those having BMI>85<sup>th</sup> percentile
- Those with hyperlipidemia or a family history of the disorder
- Those with Type 1 or 2 diabetes mellitus
- Those with family history of hypertension.<sup>61</sup>

Despite the complexity of diagnosis, the rules of prevention of hypertension in adolescents are the same as those for adults:

- Maintaining a healthy body weight
- Consuming a healthy diet
- Avoiding smoking
- Exercising regularly (at least 20 minutes on 3 or more days per week)
- Limiting alcohol and drug use<sup>63</sup>



#### **4.5.2 NONPHARMACOLOGICAL INTERVENTIONS**

Treatment of hypertension should start with non pharmacological measures. Although the magnitude of change in BP may be modest with the measures like weight loss, dietary changes and regular exercise, all of them have shown to reduce BP in adolescents successfully.

##### **a. Weight Loss**

Studies have demonstrated that modest decrease in weight not only decreases BP but also lowers other cardiovascular risk factors such as insulin resistance and dyslipidemia. Reduction in 10% of body weight results in short term reductions in BP in the range of 8-12 mmHg.<sup>62</sup>

Reinehr T et al. compared obese children who underwent an intervention program (exercise, nutrition education and behaviour therapy) and obese children who did not undergo any intervention. They found that in the intervention group there was a decline in SBP (8%), DBP (12%) and lipids. These effects were sustained even after one year.<sup>64</sup>

##### **b. Dietary changes**

Role of diet in the management of hypertension in children and adolescents has received a great attention, with particular focus on sodium. Once hypertension is established reduction in salt intake may be of benefit. Apart from sodium reduction, other dietary constituents under discussion are potassium and calcium which are said to have anti hypertensive effects.<sup>17</sup>

DASH (Dietary Approaches to Stop Hypertension) is a diet for prevention of hypertension advocated by the National Heart, Lung and Blood Institute. DASH diet is rich in fruits, vegetables and low fat dairy products. Coach SC et al. compared the efficacy of DASH diet and routine nutrition care among adolescents. They found that those on DASH diet had a greater decrease in SBP z scores ( $P < 0.01$ ). Also those on DASH had a greater increase in intake of fruits, potassium and magnesium and also a greater decrease in total fat from baseline to treatment ( $P < 0.05$ ).<sup>65</sup>

### **c. Regular physical exercise**

Regular aerobic physical activity, adequate to achieve a level of physical fitness, may be of beneficial to both treatment and prevention of hypertension.<sup>61</sup> However cessation of regular exercise is generally followed by a rise in BP to pre exercise levels. Aerobic exercises (running, walking, cycling) are preferred over static exercises in the management of hypertension. Those children who are already undergoing the above activities should increase their frequency or intensity of these activities. Exercise should be combined with dietary changes in order to achieve good reduction in BP.<sup>62</sup> Torrance B et al. reported that 40 minutes of moderate to vigorous aerobic physical activity 3-5 days/week is required to improve vascular function and reduce BP in obese children.<sup>66</sup>

### **d. Other Lifestyle changes**

- Stop smoking
- Avoid excess of alcohol
- Avoid medications or drugs (eg. Amphetamines)

Apart from its role in hypertension, smoking is a major risk factor for cardiovascular diseases and therefore should be avoided by hypertensives.<sup>61</sup>

### 4.5.3 PHARMACOLOGICAL TREATMENT

#### 4.5.3.1 Need for Pharmacological management

There are ample evidences proving the development of hypertensive end organ damage in hypertensive children and there are data suggesting hypertension in young may have adverse cardiovascular effects in adulthood.

Also there are very few data regarding the long term effects of anti hypertensives on the growth of adolescents. So, definite indications for starting medications to be ascertained before drugs are prescribed.

Accepted indications for usage of anti hypertensives for treating hypertension in children and adolescents include the following: <sup>22</sup>

**Table 10: Indications for Anti Hypertensive medications in Adolescents**

- |   |
|---|
| <ul style="list-style-type: none"><li>▪ Symptomatic hypertension</li><li>▪ Secondary hypertension</li><li>▪ Hypertensive target organ damage</li><li>▪ Type 1 or 2 diabetes</li><li>▪ Persistent hypertension despite of non pharmacologic measures</li></ul> |
|---|

Pharmacologic reduction of BP in hypertensive children who fall into the above categories is likely to result in health benefits. Other indications for starting drug therapy have been proposed. For example, it is suggested that anti hypertensive therapy is initiated if the child has hyperlipidemia.

#### 4.5.3.2 Anti Hypertensive Medications in Hypertensive Adolescents<sup>62</sup>

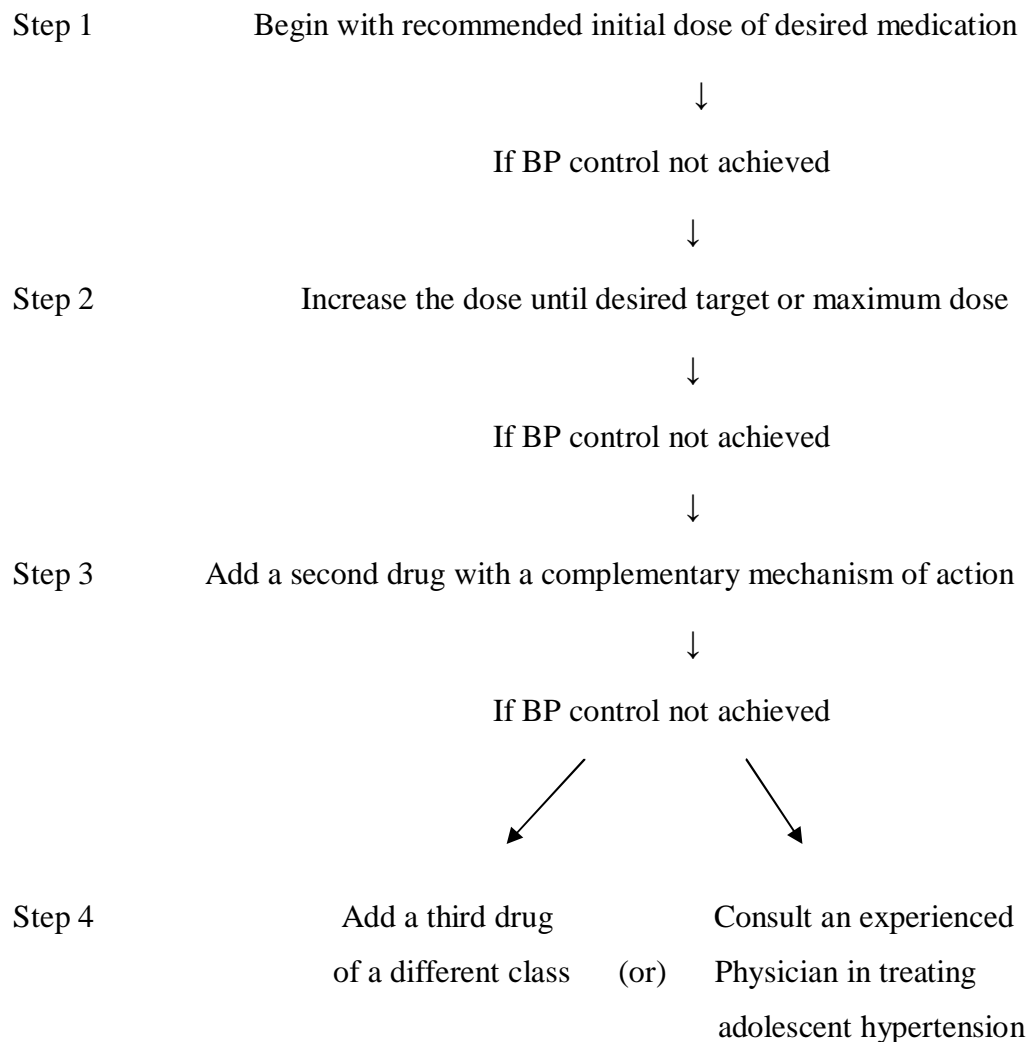
The number of anti hypertensive medications used for treating adolescent hypertension has markedly increased over the past decade. The recommended medications and the dosage are given below (Table 11).

**Table 11: Anti Hypertensive Medications in Hypertensive Children and Adolescents**

Class	Drug	Starting dose	Interval	Maximum dose
ACE inhibitors	Captopril	0.3-0.5	BID-TID	6 mg/kg/day
	Enalapril	mg/kg/dose	QD	0.6 mg/kg/day
	Lisinopril	0.08 mg/kg/day	QD	0.6 mg/kg/day
		0.07 mg/kg/day upto 5 mg/ day		
Angiotensin receptor blockers	Candesartan	4 mg/day	QD	32 mg/day
	Losartan	0.75 mg/kg/day	QD	1.4 mg/kg/day
	Olmesartan	2.5 mg/day	QD	40 mg/day
	Valsartan	1.3 mg/kg/day	QD	2.7 mg/kg/day
$\alpha$ and $\beta$ adrenergic antagonists	Labetolol	2-3 mg/kg/day	BID	10-12 mg/kg/day
	Carvedilol	0.1 mg/kg/dose	BID	0.5 mg/kg/dose
$\beta$ adrenergic agonists	Atenolol	0.5-1 mg/kg/day	QD-BID	2 mg/kg/day
	Bisoprolol	0.04 mg/kg/day	QD	10 mg/day
	Metoprolol	1-2 mg/kg/day	BID	6 mg/kg/day
Calcium channel blockers	Amlodipine	0.06 mg/kg/day	QD	0.3 mg/kg/day
	Felodipine	2.5 mg/day	QD	10 mg/day
	Isradipine	0.05 mg/kg/dose	TID-ID	0.8 mg/kg/day
	Ext. release nifedipine	0.25-0.5 mg/kg/day	QD-BID	3 mg/kg/day

#### 4.5.4 APPROACH TO PHARMACOLOGIC MANAGEMENT OF HYPERTENSION

**Figure 1: Stepwise approach to Pharmacologic management of Hypertension<sup>17</sup>**  
**(For General Practitioners)**



## 4.6 CLASSIFICATION AND MANAGEMENT OF HYPERTENSION IN ADOLESCENTS

The following table shows the classification of blood pressure among adolescents, its evaluation, life style changes for each category and also the pharmacological treatment. (Table 12)

**Table 12: Classification and Management of Hypertension in Adolescents<sup>17</sup>**

<b>Classification</b>	<b>SBP or DBP percentile</b>	<b>Frequency of measurement</b>	<b>Therapeutic Lifestyle changes</b>	<b>Pharmacologic Therapy</b>
<b>Normal</b>	<90 <sup>th</sup> percentile	Next scheduled examination	Encourage healthy diet, physical activity	-
<b>Pre hypertension</b>	90-95 <sup>th</sup> percentile or >120/80	Recheck after 6 months	Counsel for weight management, introduce physical activity and diet management	Do not start therapy unless compelling indications like CKD, diabetes, heart failure, LVH exist
<b>Hypertension</b>	>95 <sup>th</sup> percentile	Recheck in 1-2 weeks; if persistently elevated in 2 additional occasions, evaluate or refer within 1 month	Counsel for weight management, introduce physical activity and diet management	Initiate therapy or if compelling indications as above

#### **4.7 INITIATIVES FOR PREVENTION OF HYPERTENSION**

WHO has issued guidelines for assessment and management of cardiovascular risk. It provides a framework for formulation of national guidelines on prevention of cardiovascular diseases.<sup>67</sup> To increase the awareness among people about Hypertension and its complications “World Hypertension Day” is being celebrated every year on May 17. It was initiated by World Hypertension League in partnership with International Society of Hypertension and International Diabetes Federation. Theme for this year (2011) is Know your numbers-Target your Blood Pressure.<sup>68</sup>

In India National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases & Stroke has been initiated with the aim of integrating NCD interventions for optimization of scarce resources. The pilot program was launched in the year 2008 in 7 states. It was planned to be implemented in 100 districts in 21 states during 2010-2012.

The major strategy under the programme is prevention of risk factors through behaviour change. The risk factors included were unhealthy diet, physical inactivity, stress and consumption of tobacco & alcohol. The programme attempts to prevent these risk factors by creating general awareness about the Non Communicable Diseases and promotion of healthy life style habits among the community. These targeted intervention programmes were mainly designed to bring awareness among school students.<sup>69</sup>

With all the above literature it becomes clear that hypertension among adolescent age group is an important health problem and if diagnosed early the future complications can be prevented. So, this study was planned to find out the prevalence of hypertension among the adolescent population.

# **MATERIALS AND METHODS**



## **5. MATERIALS AND METHODS**

### **5.1 STUDY DESIGN**

This study was done as a cross-sectional study to find out the prevalence of hypertension among school students aged 14 to 17 years in rural areas of Kancheepuram district, Tamil Nadu.

### **5.2 STUDY PERIOD**

The study was done between March 2011 and November 2011.

### **5.3 STUDY AREA AND POPULATION**

The study was conducted among students in the age group of 14 to 17 years studying in Class IX – Class XII in four selected Higher Secondary Schools in rural areas of Kancheepuram district.

**Inclusion Criteria:** The students of age 14 to 17 years, studying Class IX to Class XII were chosen because of the following reasons:

- Mid (14-16 years) and late adolescents (17-19 years) will be able to understand better and answer the self administered questionnaire when compared to the early adolescents (10-13 years).
- Students in these age groups are usually present in Class IX to Class XII and the majority of the students complete their school education by 17 years of age.

**Exclusion Criteria:** The students who were absent during the study period and the students whose parents were not willing to allow their children to participate in the study were not included in the study. The students above 17 years of age were excluded since they were minimal in number and construction of percentile charts for Blood Pressure needs a good number of students.

#### 5.4 SAMPLE SIZE

The Sample size was calculated on the basis of 9.4% prevalence rate of hypertension among school children in Aligarh in a study conducted by Durrani AM et al, with allowable error of 20%, using the formula,

$$n = \frac{Z^2 \alpha^2 p \times q}{d^2}$$

$$\text{where } Z_{\alpha^2} = 1.96 \text{ for 95\% confidence interval}$$

$$p = 10 \qquad q = 90$$

$$d = 20\% \text{ of } P(10\%) = 2$$

$$n = \frac{Z^2 \alpha^2 p \times q}{d^2}$$

$$= \frac{1.96 \times 1.96 \times 10 \times 90}{2 \times 2}$$

$$= \mathbf{865}$$

Assuming 10% non response, sample size is calculated as **950**.

#### 5.5 SAMPLING METHOD

The study was carried out using two stage random sampling method to select the participants from Higher Secondary Schools in Kancheepuram district. Kancheepuram District has been divided into Chengalpattu and Kancheepuram educational districts. List of schools were obtained from the District Educational Office in the two educational districts. There are 79 Higher Secondary schools in Chengalpattu and 45 in Kancheepuram educational districts.

In the first stage 2 schools were selected randomly by lottery method from Chengalpattu and Kancheepuram educational districts. Totally 4 schools were selected. List of selected schools were given in Annexure IV. The total number of students in the 4 schools was 2354.

The number of students to be selected from each school was calculated by Population Proportionate to Size method. For example in Govt. Higher Secondary School, Anjur-

Number of students in the school = 490

Number of samples from the school =  $490 \times 950 / 2354$

= 198.

Similarly samples to be selected from other schools were calculated. (Table 13)

**Table 13: List of selected Schools with no. of samples from each school**

S.no.	Name of the School	Strength (Class IX- Class XII)	No. of students selected
1.	Government Higher Secondary School, Anjur.	490	198
2.	Government Higher Secondary School, Paalur.	505	204
3.	Government Higher Secondary School, Mathur.	817	330
4.	Government Higher Secondary School, Salavakkam.	542	218
<b>Total</b>		<b>2354</b>	<b>950</b>

In the second stage the students of 14-17 years of age studying Class IX to Class XII in selected schools and present on that day were enlisted. Continuous numbers were given to all of them and with the help of computer generated random numbers the required number of students were selected.

Number of Higher Secondary Schools	=	79+45
Number of Schools selected	=	4
Total no. of students in selected schools	=	2354
Number of students selected	=	950
Number of students included in the study after consent from parents = <b>934</b>		

## **5.6 RESEARCH INSTRUMENTS**

### **5.6.1 QUESTIONNAIRE**

The study was done using a pre tested and structured questionnaire. The questionnaire for this study was based on the Global School Health Survey Questionnaire developed by WHO. The questionnaire in English has been translated to Tamil and retranslated into English to check for correctness of translation. Then the questionnaire was pre tested among the students and necessary changes were made. The variables under diet pattern and physical activity were classified based on the common practices observed among students in the pilot study. The results of the pilot test were not included in the analysis.

The questionnaire was divided into four parts.

#### **Part I- Socio demographic profile & Family history**

In the first part socio demographic details like age, sex, family members and income were asked. Family history of Hypertension, Diabetes mellitus, CAD and stroke among parent and siblings was also enquired.

## **Part II - Details of diet pattern**

Under diet pattern frequency of intake of food items (vegetables, fruits, non vegetarian foods and junk foods) during the last week, type of oil used and salt intake were asked. In dietary pattern decreased intake of fruits (<2 days /week), decreased intake of vegetables (<2 days /week), increased intake of non-vegetarian foods (>2 days /week), high intake of junk foods (>2 days /week), use of oil with high saturated fatty acids and high intake of salt (>15 gm/day) were considered as risk factors in this study.

## **Part III - Details of Physical activity**

Mode of transport to school, frequency of playing outdoor games, hours of play and duration of Television watching were enquired in this part. Under physical activity following were taken as reflection of sedentary behaviour and considered as risk factors in the study population: mode of transport to school by motor vehicles (bus/van/auto/motorcycle), decreased frequency of playing out door games (<2 days /week), decreased duration of playing outdoor games (<1 hr/day) and increased duration of TV watching (>1 hr/day).

## **Part IV - Measurements-Height, Weight, BMI, Blood Pressure**

In the final part measurements – Height, Weight, Blood pressure were recorded. BMI was calculated from height and weight measurements.

### **5.7 DATA COLLECTION**

Initially permission to conduct the study was obtained from The Director, Institute of Community Medicine and The Dean, Madras Medical College. Then, approval was obtained from the Institutional Ethical Committee. After that permission was obtained from Director of School Education and Headmaster/ Headmistress of the selected schools.

In each of the selected school, the help of the Physical director was sought. A brief discussion with them was done. Then with their help the selected students were given parental consent forms and asked to return back the next day. Those who returned the parent consent forms were included in the study.

The selected students were assembled in a convenient place and questionnaires were distributed. The students were asked to observe silence and read the questionnaire. Doubts were cleared and the students were asked to take the questionnaires home and fill it up with the help of their parents, since enquiry on the type of oil used and salt intake, etc. were in the questionnaire.

Then from next day onwards measurements – Height, Weight and Blood Pressure were taken and entered in the questionnaire. All the measurements were taken by the investigator and on an average 30-40 students were examined per day. The questionnaires were collected from the students. At last all the students were assembled and health education was given regarding life style changes such as diet, physical activity and avoiding smoking & alcohol. The School faculties and students were thanked for their full co-operation during the study. The same procedure was followed in all the selected schools.

The school authorities were informed about the students who were identified as hypertensives after the analysis of the data. A special session was conducted for the identified hypertensives on health education on life style modification and need for evaluation. The school authorities were requested to inform the parents regarding the health status of their children. Also further referral to the nearest Primary Health Centre and follow up during the school health services were recommended.

## **5.8 MEASUREMENTS**

### **5.8.1 HEIGHT**

Height was measured using a portable plastic stadiometer (Bioplus™) which is a wall mountable type of stadiometer which has measurement markings up to 200cm and the same instrument was used throughout the study. The subject has to stand in an erect posture without wearing shoes/footwear. He/she was asked to look straight and the end of the instrument was lowered and height was recorded accordingly.

### **5.8.2 WEIGHT**

Weight was measured using a portable weighing machine (Belita®). The same machine was used throughout the study. The participant was asked to stand still on it with the body weight evenly distributed. Usual school dress can be worn but without shoes/any foot wear. Weight was measured accordingly. The scale was zeroed before weighing each student and also machine was calibrated before each visit using standard known weights.

### **5.8.3 BLOOD PRESSURE**

Blood pressure was measured using the mercury sphygmomanometer (Diamond Deluxe Mercury BP apparatus) and the following procedures were followed while measuring blood pressure:

- The subject was asked to rest for five minutes and no caffeine / smoking before an hour
- BP was measured in the right arm with the subject in sitting position and with the arm at the level of the heart

- Appropriate sized cuff was used which covers two thirds of the arm and the cuff was applied evenly on the bare right arm with the lower edge approximately 2.5 cm above the ante cubital fossa.
- The blood pressure was recorded with the same sphygmomanometer and by the same observer throughout the study
- '0' reading was ensured before recording the blood pressure each time
- The cuff pressure was inflated to 20mmHg above the level at which the radial pulse disappeared, then deflated slowly at the rate of 2mmHg/second and the reading recorded to the nearest 2mmHg. The first and the fifth Korotkoff sounds were taken as indicative of the systolic and diastolic blood pressure respectively
- WHO criteria was followed in recording BP and the average of the two readings recorded 5 minutes apart was taken as BP

BP percentiles were calculated for each age and sex. Those with SBP or DBP >95<sup>th</sup> percentile were classified as hypertensives. Those with SBP or DBP between 90<sup>th</sup> to 95<sup>th</sup> percentile or >120/80 mmHg were termed as pre hypertensives. But since the role of prehypertension in adolescents has not been well defined they were not taken into account.

## **5.9 ANALYSIS**

Data was entered into Microsoft excel spread sheet. Analysis was done using SPSS for Windows 12.0 software. Continuous data were expressed in terms of mean and standard deviation and categorical data as proportions. Correlation was tested by Correlation co-efficient. To test the association Chi square test was used for categorical variables and P value < 0.05 was taken as statistically significant.



## **5.10 OPERATIONAL DEFINITIONS**

### **5.10.1 BMI**

BMI was calculated using the formula

$$\text{BMI} = \frac{\text{Weight (in Kilograms)}}{\{\text{Height (in meters)}\}^2}$$

BMI percentiles were calculated for each age and sex group. Those with BMI percentile between 5<sup>th</sup> to 85<sup>th</sup> percentile were taken as normal. Those with BMI percentile between 85<sup>th</sup> percentile and 95<sup>th</sup> percentile were considered as overweight and above 95<sup>th</sup> percentile as obese.<sup>37</sup>

### **5.10.2 BLOOD PRESSURE**

The 5<sup>th</sup> to 95<sup>th</sup> percentiles of systolic and diastolic Blood Pressures were calculated for each age (14years to 17 years) and sex group. The students were classified as hypertensives if their SBP or DBP or both is more than 95<sup>th</sup> percentile for their age and sex.<sup>22</sup>

### **5.10.3 SOCIO ECONOMIC CLASSIFICATION**

Modified BG Prasad classification was used to classify the participants based on the per capita income of the family (Annexure III). Accordingly participants were classified into Classes I to V.

# RESULTS

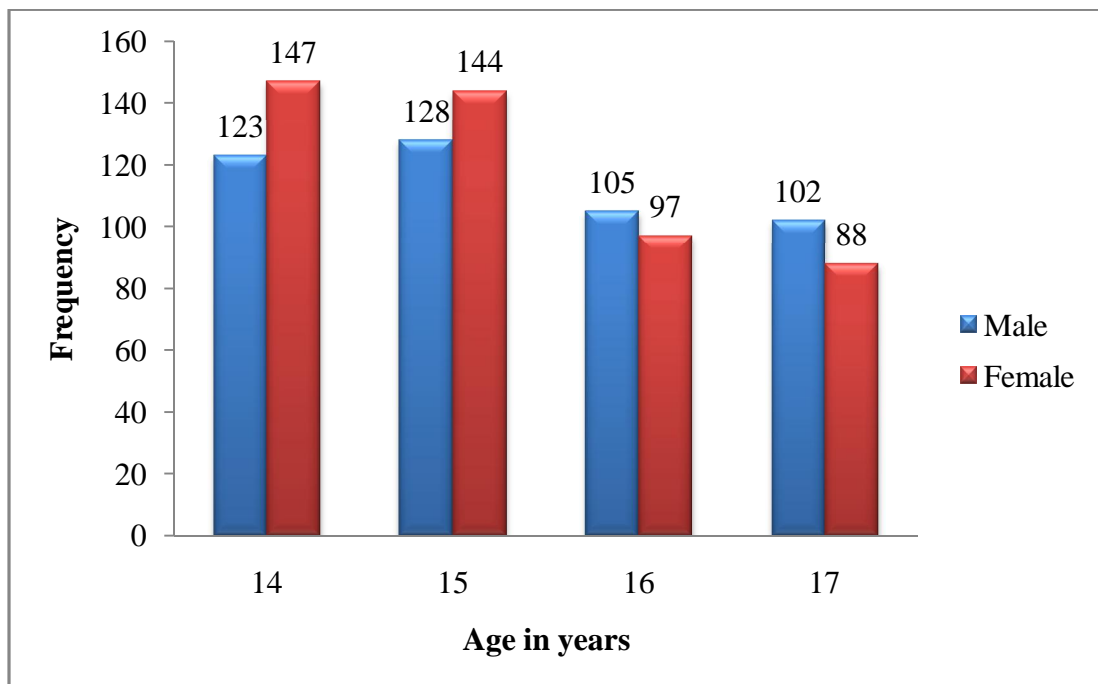
## 6. RESULTS

This cross sectional study included 934 participants from four selected schools in Kancheepuram district. The study estimated the prevalence of hypertension among the participants and also the risk factors of hypertension.

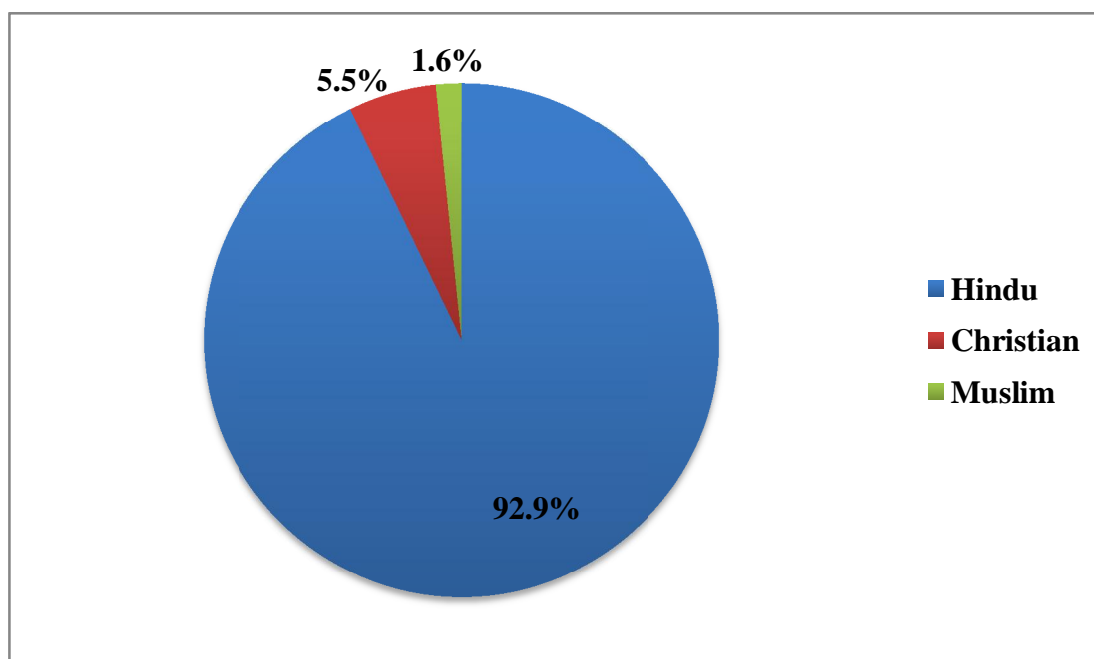
### 6.1 Socio demographic details

Among the 934 adolescents who took part in the study 458 (49%) were boys and 476 (51%) were girls. According to age wise distribution 270 (28.9%) were aged 14 years, 272 (29.1%) were aged 15 years, 202 (21.6%) were aged 16 years and the remaining 190 (20.3%) were of 17 years of age. The sex wise distribution in each age group was shown in (Figure 2). It was also seen that among the study participants 92.9% were Hindus, 5.5% Christians and 1.6% Muslims. (Figure 3)

**Figure 2: Age and Sex Wise Distribution**



**Figure 3: Religion wise distribution**



#### **6.1.1 Socio Economic Status**

The per capita income was calculated as per the total income mentioned by the participant and socio economic classification was done based on Modified BG Prasad scale (Annexure III). It was seen that 5.6% belonged to Class I, 33.5% belonged to Class II, 26.3% belonged to Class III, 25.5% belonged to Class IV and the remaining 9.1% belonged to Class V. (Table 14)

**Table14: Socio Economic Distribution**

Percapita Income (Rs.)	Class	Number	Percentage
2830 &above	I	52	5.6%
1415-2829	II	313	33.5%
850-1414	III	246	26.3%
425-849	IV	238	25.5%
<425	V	85	9.1%
<b>Total</b>		934	100%

## 6.2 PREVALENCE OF HYPERTENSION

### 6.2.1 Blood Pressure percentile among boys

Nomograms for blood pressure were constructed for the study group (14-17years). Separate percentile charts for boys and girls were framed. Table-15 shows the percentile chart for boys. It was seen that 5<sup>th</sup> and 95<sup>th</sup> percentile SBP for 14 years aged boys were 86 mmHg and 135.6 mmHg and it progressively increases with age to 100.3 mmHg and 139.4 mmHg at 17 years of age. And for DBP 5<sup>th</sup> and 95<sup>th</sup> percentile at 14 years of age were 54.4 mmHg and 80 mmHg. The same at 17 years were 56 mmHg and 84 mmHg. But the progression was not uniform like that of SBP.

**Table 15: Blood Pressure percentile among boys**

Percentiles								
SBP (mmHg)	Age(yrs)	5	10	25	50	75	90	95
	14	86	90	98	104	112	128	135.6
	15	90	95.6	100	110	118	128	138
	16	90.6	100	110	118	123	132	138.8
	17	100.3	104	110	116	126	133.4	139.4
DBP (mmHg)	14	54.4	56.8	60	68	70	80	80
	15	50	50	60	70	76	80	80
	16	54	56	60	70	78	84	89.4
	17	56	60	66	70	78	82	84

### 6.2.2 Blood Pressure Percentile chart for Girls:

Table 16 shows the BP percentile chart for girls 14-17 years of age. It was seen that the 5<sup>th</sup> and 95<sup>th</sup> percentile SBP were 90 mmHg and 133.6 mmHg at 14 years and it was 90 mmHg and 135.3 mmHg at 17 years. For DBP the corresponding values were 54 mmHg and 86 mmHg at 14 years and 60 mmHg and 87.3 mmHg at 17 years. There was a steady increase in percentile values for DBP values among girls. On comparison with the boys the SBP percentile values were lower among girls whereas DBP percentile values were higher among girls.

**Table 16: Blood Pressure Percentile among Girls**

Percentiles								
SBP mmHg	Age(yrs)	5	10	25	50	75	90	95
	14	90	90	100	110	120	128	133.6
	15	96	100	102	110	120	124	131.5
	16	98	100	107	110	124	132.4	136.4
	17	90	95.6	100	110	120	130	135.3
DBP mmHg	14	54	56	60	70	76	80	86
	15	54	58	60	70	76	80	86
	16	55.6	58	65	70	79	82	88
	17	60	60	68	72	80	82	87.3

### 6.2.3 Blood Pressure percentile chart for the study population

Table 17 shows the BP percentile chart for the whole study population. The 5<sup>th</sup> and 95<sup>th</sup> percentiles SBP at 14 years were 90 mmHg and 134.9 mmHg. At 17 years the corresponding values were 96 mmHg and 136 mmHg respectively. 5<sup>th</sup> and 95<sup>th</sup> DBP percentile values were 54 mmHg and 81.8 mmHg at 14 years and 58 mmHg and 86 mmHg at 17 years respectively.

**Table 17: Blood Pressure Percentile among the study population**

Percentiles								
SBP mmHg	Age(yrs)	5	10	25	50	75	90	95
	14	90	90	100	108	118	128	134.9
	15	90.1	98	100	110	120	127.8	136
	16	94.3	100	110	114	124	132	137.7
	17	96	100	108	112	124	132	136
DBP mmHg	14	54	56	60	70	72	80	81.8
	15	50	56	60	70	76	80	83.9
	16	54	56	62	70	78	84	88
	17	58	60	68	72	80	82	86

#### 6.2.4 DISTRIBUTION OF BP AND HYPERTENSION AMONG BOYS

Table 18 shows the mean SBP and DBP among boys and also the prevalence of hypertension among them with 95% confidence interval. The mean SBP at 14 years was 106.24 mmHg and at 17 years it was 118.05 mmHg. Similarly mean DBP was 67.4 mmHg and 71.49 mmHg at 14 and 17 years respectively. Overall mean SBP was 112.48 mmHg and mean DBP was 68.86 mmHg. Out of the 458 boys 33 (7.2%) were found to be hypertensives (95% CI: 2.6%-13.05%). As seen in the table the prevalence of hypertension increases gradually from 6.5% in boys aged 14 years to 7.84% in 17 years.

**Table 18: Age wise distribution of Blood Pressure and Hypertension among Boys**

<b>Age</b>	<b>No.</b>	<b>Mean SBP (SD)</b>	<b>Mean DBP (SD)</b>	<b>Hypertension No. (%)</b>	<b>95% CI for Hypertension</b>
<b>14</b>	123	106.24(14.54)	67.4(9.07)	8(6.5%)	2.15% - 10.85%
<b>15</b>	128	110.34(12.9)	67.9(10.32)	9(7.03%)	2.60%-11.45%
<b>16</b>	105	116.94 (13.09)	69.35 (10.95)	8(7.62%)	2.54%-12.69%
<b>17</b>	102	118.05 (12.04)	71.49 (8.71)	8(7.84%)	2.6%-13.05%
<b>Total</b>	<b>458</b>	<b>112.48(13.97)</b>	<b>68.86(9.88)</b>	<b>33(7.2%)</b>	<b>4.83%-9.56%</b>



### 6.2.5 DISTRIBUTION OF BP AND HYPERTENSION AMONG GIRLS

The mean SBP, DBP and prevalence of hypertension among girl students were shown in the Table-19. The overall mean SBP was 111.48 mmHg and DBP was 70.16 mmHg. The mean SBP (115.16 mmHg) was high among girls 16 years of age. And mean DBP was high (73.16 mmHg) among 17 years. Among 476 girl students examined 34 (7.14%) were found to have hypertension (95% CI: 4.82%-9.45%). The prevalence of hypertension was increasing with age. 6.8% were hypertensives at 14 years and 6.94%, 7.22%, 7.95% were found to have hypertension at 15, 16 and 17 years of age respectively.

**Table 19: Age wise distribution of Blood Pressure and Hypertension among Girls**

<b>Age</b>	<b>No.</b>	<b>Mean SBP (SD)</b>	<b>Mean DBP (SD)</b>	<b>Hypertension No. (%)</b>	<b>95% CI for Hypertension</b>
<b>14</b>	147	109.96(13.92)	68.44(10.53)	10(6.8%)	2.73%-10.86%
<b>15</b>	144	111.07(10.43)	69.61(9.078)	10(6.94%)	2.78%-11.09%
<b>16</b>	97	115.16(13.29)	71.24(9.66)	7(7.22%)	2.06%-12.37%
<b>17</b>	88	110.7(12.75)	73.16(8.41)	7 (7.95%)	2.29%-13.60%
<b>Total</b>	<b>476</b>	<b>111.48(12.68)</b>	<b>70.16(9.65)</b>	<b>34(7.14%)</b>	<b>4.82%-9.45%</b>

### 6.2.6 DISTRIBUTION OF BLOOD PRESSURE AND HYPERTENSION AMONG THE STUDY POPULATION

Overall out of the 934 students examined 67 (7.17%) were found to have hypertension (95% CI: 5.51%-8.82%). It was observed that the prevalence of hypertension increased with age. From 6.67 % at 14 years of age to 6.98%, 7.43% and 7.89% at 15, 16 and 17 years of age respectively. The mean SBP was found to be 111.96 mmHg (98.64 -125.28) and the mean DBP was 69.53 mmHg (59.75-79.31). The mean SBP was high at 16 years of age (116.09 mmHg) and the mean DBP was seen to increase with age with the maximum at 17 years of age (72.26 mmHg).

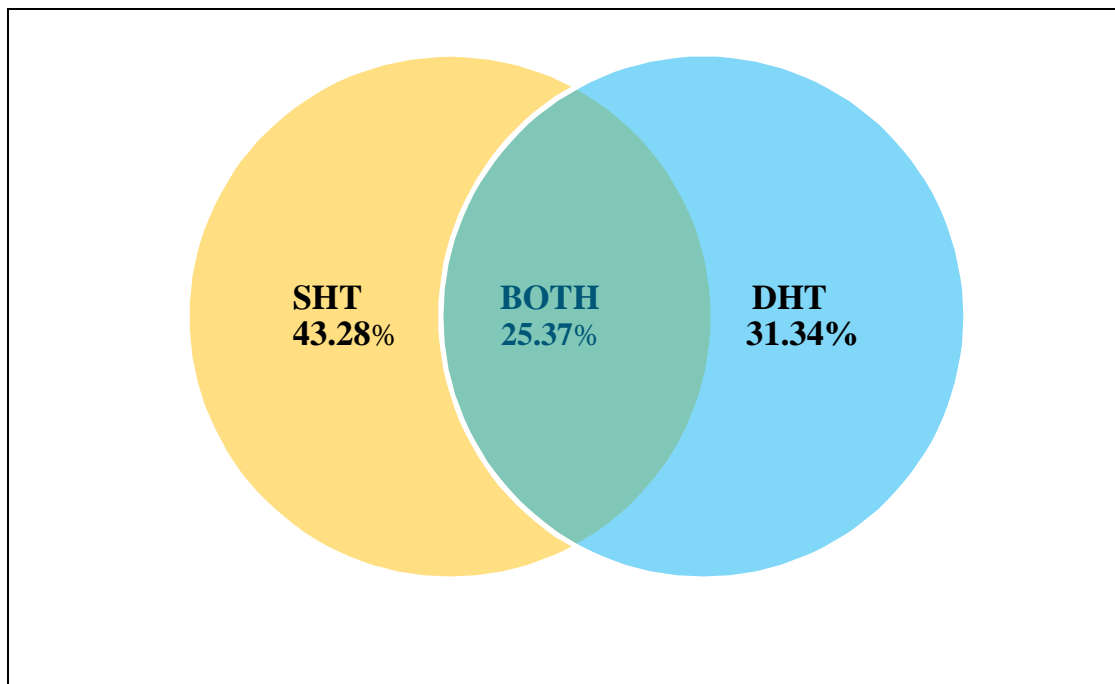
**Table 20: Age wise distribution of Blood Pressure and Hypertension among the study population**

<b>Age</b>	<b>No.</b>	<b>Mean SBP (SD)</b>	<b>Mean DBP (SD)</b>	<b>Hypertension No. (%)</b>	<b>95% CI for Hypertension</b>
<b>14</b>	270	108.27(14.3)	67.96(9.88)	18(6.67%)	3.69%-9.64%
<b>15</b>	272	110.81(11.63)	68.72(9.63)	19(6.98%)	3.95%-10.00%
<b>16</b>	202	116.09(13.2)	70.26(10.37)	15(7.43%)	3.81%-11.04%
<b>17</b>	190	114.65(12.87)	72.26(8.59)	15(7.89%)	4.05%-11.72%
<b>Total</b>	<b>934</b>	<b>111.96(13.32)</b>	<b>69.53(9.78)</b>	<b>67(7.17%)</b>	<b>5.51%-8.82%</b>

### 6.2.7 TYPE OF HYPERTENSION

Among the 67 hypertensives 29 (43.28%) were having Isolated Systolic Hypertension, 21 (31.34%) were having Isolated Diastolic Hypertension and the remaining 17 (25.37%) were having both Systolic and Diastolic Hypertension. The distribution was shown in Figure 4.

**Figure 4: Distribution of type of Hypertension**



## 6.3 PREVALENCE OF OVERWEIGHT AND OBESITY

### 6.3.1 Prevalence of overweight and obesity among Boys

From Table 21 it was seen that the mean BMI among boys was 16.95 and it was also observed that the BMI was increasing with age. The 85<sup>th</sup> percentile and 95<sup>th</sup> percentile of BMI given in the table were the cut off points for overweight and obesity among boys. According to that 39 (8.51%) were identified as overweight and 21 as obese (4.58%).

**Table 21: Mean BMI, BMI percentile, Overweight and Obesity among Boys**

Age	No.	Mean BMI (SD)	BMI Percentile		Over weight No. (%)	Obese No. (%)	Total No. (%)	95% CI
			85 <sup>th</sup>	95 <sup>th</sup>				
<b>14</b>	123	16.07 (3.21)	17.78	22.74	8 (6.50%)	6 (4.88%)	14 (11.38%)	5.77%- 16.99%
<b>15</b>	128	16.69 (2.53)	18.49	22.86	12 (9.37%)	6 (4.69%)	18 (14.06%)	8.03%- 20.08%
<b>16</b>	105	17.46 (2.43)	19.66	23.54	9 (8.57%)	4 (3.81%)	13 (12.38%)	6.08%- 18.68%
<b>17</b>	102	17.80 (2.81)	20.20	23.85	10 (9.80%)	5 (4.90%)	15 (14.70%)	7.82%- 21.57%
<b>Total</b>	458	16.95 (2.84)	18.92	22.94	39 (8.51%)	21 (4.58%)	60 (13.10%)	10.00%- 16.19%

**Table 22: Mean BMI, BMI percentile, Overweight and Obesity among Girls**

Age	No.	Mean BMI (SD)	BMI percentile		Over Weight No. (%)	Obese No. (%)	Total No. (%)	95% CI
			85 <sup>th</sup>	95 <sup>th</sup>				
<b>14</b>	147	17.49 (2.69)	19.75	22.52	13 (8.84%)	7 (4.76%)	20 (13.60%)	7.64%- 18.55%
<b>15</b>	144	18.42 (2.53)	20.92	23.04	14 (9.72%)	6 (4.16%)	20 (13.88%)	8.23%- 19.52%
<b>16</b>	97	19.35 (3.66)	23.72	26.28	10 (10.3%)	3 (3.09%)	13 (13.40%)	6.62%- 20.17%
<b>17</b>	88	19.76 (3.79)	23.80	26.65	7 (7.95%)	4 (4.54%)	11 (12.50%)	5.59%- 19.41%
<b>Total</b>	476	18.58 (3.21)	21.89	24.50	44 (9.24%)	20 (4.20%)	64 (13.44%)	10.37%- 16.50%

### 6.3.2 Prevalence of overweight and obesity among Girls

It was seen that the mean BMI among girls was 18.58 and 44(9.24%) were identified as overweight and 20(4.20%) as obese. The mean BMI was found to be increasing with age from 17.49 at 14 years to 19.76 at 17 years of age. Age wise distribution of overweight and obesity was also shown in the Table 22.

### 6.3.2 Prevalence of overweight and obesity among the study population

Table 23 shows that the mean BMI of the study population was 17.78 with a standard deviation of 3.14 and the mean BMI increases from 16.84 at 14 years to 18.52 at 17 years of age. Among the study population 83(8.89%) were overweight, 41(4.4%) were obese and overall the prevalence of overweight/ obesity was found to be 13.28%.

**Table 23: Mean BMI, BMI percentile, Overweight and Obesity among the study population**

Age	No.	Mean BMI (SD)	BMI Percentile		Over Weight No. (%)	Obese No. (%)	Total No. (%)	95% CI
			85 <sup>th</sup>	95 <sup>th</sup>				
14	270	16.84 (3.02)	19.61	22.64	21 (7.77%)	13 (4.8%)	34 (12.59%)	8.63% - 16.55%
15	272	17.61 (2.67)	20.44	22.94	26 (9.56%)	12 (4.4%)	38 (13.97%)	9.85% - 18.09%
16	202	18.50 (3.34)	21.93	24.83	19 (9.41%)	7 (3.5%)	26 (12.87%)	8.25% - 17.49%
17	190	18.52 (3.32)	22.17	25.25	17 (8.95%)	9 (4.7%)	26 (13.68%)	8.79% - 18.56%
Total	934	17.78 (3.14)	20.82	23.81	83 (8.89%)	41 (4.4%)	124 (13.28%)	11.10% - 15.46%

#### 6.4 DISTRIBUTION OF RISK FACTORS AMONG STUDY POPULATION

**Table 24: Distribution of Risk factors among the study population (N =934)**

<b>RISK FACTOR</b>	<b>FREQUENCY (N=934)</b>	<b>PERCENTAGE</b>
<b>FAMILY HISTORY</b>		
Family History of HT/DM/CAD/Stroke	139	14.88%
<b>DIETARY PATTERN</b>		
Less intake of vegetables (<2days/week)	73	7.81%
Less intake of fruits (<2days/week)	331	35.43%
High intake of Non vegetarian foods (>2days/week)	186	19.91%
High intake of junk foods (>2days/week)	468	50.10%
Usage of saturated oil	331	35.43%
High intake of salt (>15 gm/day)	235	25.16%
<b>PHYSICAL ACTIVITY</b>		
Mode of transport to school- by motor vehicles	169	25.1%
Playing outdoor games <2 days / week	388	41.54%
Playing <1 hr/day	537	57.49%
Increased duration of TV watching >1 hr	495	52.99%
<b>OVERWEIGHT/OBESE</b>		
Over weight/obese	124	13.27%

Table 24 shows the distribution of various risk factors of hypertension among the study population.

#### **Family History:**

In the study population it was observed that family history of hypertension / Diabetes mellitus /CAD / Stroke was seen among 139 (14.88%) students.

#### **Diet Pattern:**

Decreased intake of vegetables was seen among 73 (7.81%) of the study participants. Similarly decreased intake of fruits was found among 331 (35.43%) participants. High intake of non-vegetarian foods was identified among 186 (19.91%) students and high intake of salt was seen among 235 (25.16%) students. Usage of oils with high saturated fatty acid content was seen among 331 (35.43%) of the study population.

#### **Physical activity:**

Among the study population 169 (25.1%) were going to school by motor vehicles. 388 (41.54%) were playing outdoor games less frequently and decreased duration of playing games was found among 537 (57.49%) students. Increased duration of Television watching was reported among 495 (52.99%) study participants.

#### **Overweight / Obesity:**

Overweight was taken as 85<sup>th</sup> to 95<sup>th</sup> percentile of BMI for the specific age and sex. Those with BMI more than 95<sup>th</sup> percentile were taken as obese. Accordingly 124 (13.27%) were identified to be overweight/ obese among the study population.

## 6.5 ASSOCIATION OF HYPERTENSION WITH VARIOUS FACTORS

### 6.5.1 Correlation between SBP and DBP with Age, Height, Weight and BMI

There was a positive correlation observed between SBP and DBP in the study population and variables such as age, height, weight and BMI. Except for the correlation between age in girls and SBP, other variables were significantly correlated with both SBP and DBP at 0.01 level (Table 25).

**Table 25: Correlation between SBP and DBP with Age, Height, Weight and BMI**

VARIABLE		SBP	DBP
Age	Boys	0.334 <sup>*</sup>	0.152 <sup>*</sup>
	Girls	0.067	0.173 <sup>*</sup>
	Overall	0.208 <sup>*</sup>	0.157 <sup>*</sup>
Height	Boys	0.459 <sup>*</sup>	0.146 <sup>*</sup>
	Girls	0.204 <sup>*</sup>	0.201 <sup>*</sup>
	Overall	0.350 <sup>*</sup>	0.131 <sup>*</sup>
Weight	Boys	0.596 <sup>*</sup>	0.266 <sup>*</sup>
	Girls	0.453 <sup>*</sup>	0.358 <sup>*</sup>
	Overall	0.533 <sup>*</sup>	0.304 <sup>*</sup>
BMI	Boys	0.511 <sup>*</sup>	0.268 <sup>*</sup>
	Girls	0.404 <sup>*</sup>	0.297 <sup>*</sup>
	Overall	0.428 <sup>*</sup>	0.291 <sup>*</sup>

\*-- Correlation coefficient significant at 0.01 level (two tailed)



### 6.5.2 Socio demographic factors and Hypertension

**Table 26: Age and Hypertension**

		Hypertension		Total
		Yes	No	
<b>AGE</b>	14	18(6.7%)	252(93.3%)	270
	15	19(7%)	253(93%)	272
	16	15(7.4%)	187(92.6%)	202
	17	15(7.9%)	175(92.1%)	190
Total		67	867	962

$$\chi^2_{0.05} = 0.286 \quad \text{df} = 3 \quad \text{P} = 0.96 \text{ (NS)}$$

In our study it was seen (Table 26) that the prevalence of hypertension increased with age. But there was no statistically significant difference between age and hypertension.

**Table 27: Sex and Hypertension**

		Hypertension		Total
		Yes	No	
<b>Sex</b>	Male	33(7.2%)	425(92.8%)	458
	Female	34(7.1%)	442(92.9%)	476
Total		67	867	962

$$\chi^2_{0.05} = 0.001 \quad \text{df} = 1 \quad \text{P} = 0.971 \text{ (NS)}$$

Table 27 shows that there was no statistically significant difference in the prevalence of hypertension among males and females.

**Table 28: Socio economic class and Hypertension**

		Hypertension		Total
		Yes	No	
<b>Socio economic class</b>	Class I	3(5.8%)	49(94.2%)	52
	Class II	23(7.3%)	290(92.7%)	313
	Class III	15(6.1%)	231(93.9%)	246
	Class IV	19(8%)	219(92%)	238
	Class V	7(8.2%)	78(91.8%)	85
Total		70	892	962

$$\chi^2_{0.05} = 0.974 \quad \text{df} = 4 \quad \text{P} = 0.974(\text{NS})$$

Table 28 shows that hypertension was prevalent among 5.8% of socio economic Class I, 7.3% among Class II and 61% of Class III. 8% and 8.2% prevalence was seen among Class IV and Class V respectively. There was no statistically significant difference in the prevalence of Hypertension among various socio economic classes.

**Table 29: Family History and Hypertension**

		Hypertension		Total
		Yes	No	
<b>Family History</b>	<b>Yes</b>	16(11.5%)	123(88.5%)	139
	<b>No</b>	51(6.4%)	744(93.6%)	795
Total		67	867	934

$$\chi^2_{0.05} = 4.614 \quad \text{df} = 1 \quad \text{P} = 0.032(\text{SS})$$

In the study population hypertension was prevalent among 11.5% of those with a family history of HT/DM/CAD/Stroke and 6.4% among those with no such family history. It was found to be a statistically significant risk factor of hypertension (P= 0.032) (Table 29).

### 6.5.3 DIET PATTERN AND HYPERTENSION

**Table 30: Diet Pattern and Hypertension**

		Hypertension		Chi square value	df	P value
		Yes	No			
<b>Vegetables intake</b>	<2 days a week	5(6.8%)	68(93.2%)	<b>0.012</b>	<b>1</b>	<b>0.911</b>
	≥2 days a week	62(7.2%)	799(92.8%)			
<b>Fruits intake</b>	<2 days a week	24(7.3%)	307(92.7%)	<b>0.005</b>	<b>1</b>	<b>0.946</b>
	≥2 days a week	43(7.1%)	560(92.9%)			
<b>Non vegetarian food intake</b>	≥2 days a week	9(4.8%)	177(95.2%)	<b>1.901</b>	<b>1</b>	<b>0.168</b>
	<2 days a week	58(7.8%)	690(92.2%)			
<b>Junk foods intake</b>	≥2 days a week	33 (6.9%)	442(93.1%)	<b>0.074</b>	<b>1</b>	<b>0.785</b>
	<2 days a week	34(7.4%)	425(92.6%)			
<b>Cooking oil</b>	Saturated oil	23(6.9%)	308(93.1%)	<b>0.039</b>	<b>1</b>	<b>0.844</b>
	Unsaturated oil	44(7.3%)	559(92.7%)			
<b>Salt Intake</b>	>15 g/day	50(7.2%)	649(92.8%)	<b>0.002</b>	<b>1</b>	<b>0.967</b>
	<15 g/day	17(7.2%)	218(92.8%)			
<b>Total</b>		<b>67</b>	<b>867</b>			

Table 30 shows the association of dietary pattern and hypertension. It was found that there was no statistically significant association between any of the dietary factors and hypertension.

#### 6.5.4 PHYSICAL ACTIVITY AND HYPERTENSION

**Table 31: Physical Activity and Hypertension**

		Hypertension		Chi square value	df	P value
		Yes	No			
<b>Mode of going to school</b>	Bus/van/ auto/motorcycle	13 (7.7%)	156(92.3%)	<b>0.083</b>	<b>1</b>	<b>0.77</b>
	Cycle/walking	54 (7.1%)	711(92.9%)			
<b>Frequency of playing outdoor games</b>	<2 days/ don't play	28(7.2%)	360(92.8%)	<b>0.002</b>	<b>1</b>	<b>0.96</b>
	≥2 days a week	39 (7.1%)	507(92.9%)			
<b>Hours of play</b>	<1 hr	36(6.7%)	501(93.3%)	<b>0.418</b>	<b>1</b>	<b>0.52</b>
	>1 hr	31(7.8%)	366(92.2%)			
<b>Hours of Television watching</b>	>1hr	36(7.3%)	459(92.7%)	<b>0.016</b>	<b>1</b>	<b>0.9</b>
	<1 hr/don't watch	31(7.1%)	408(92.9%)			
	Total	67	867			

It was found that there was no statistically significant association between hypertension and physical activity in the study population (Table 31).

### 6.5.5 OVERWEIGHT/OBESE AND HYPERTENSION

**Table 32: Overweight/obese and Hypertension**

		Hypertension		Total
		Yes	No	
<b>Over Weight/ Obese</b>	<b>Yes</b>	31(25%)	93(75%)	124
	<b>No</b>	36(4.4%)	774(95.6%)	810
Total		67	867	934

$$\chi^2_{0.05} = 68.237 \quad \text{df} = 1 \quad \text{P} < 0.001 \text{ (SS)}$$

Among the study population hypertension was prevalent among 25% of those with overweight or obesity whereas it was 4.4% among those with normal BMI (Table 32). And there was a statistically significant association between overweight / obesity and hypertension.

# DISCUSSION

## 7. DISCUSSION

This school based cross sectional study was done to find out the prevalence of hypertension among school students aged 14-17 years and also to identify the risk factors of hypertension such as overweight & obesity, diet and physical activity among them. The study was carried out in four selected Higher Secondary Schools in rural areas of Kancheepuram district.

The study included 934 students of which 458 (49%) were boys and 476 (51%) were girls. Majority of the study participants were Hindus (92.9%). Based on Modified BG Prasad's Classification for socio economic status 5.6% belonged to Class I, 33.5% of the study population belonged to Class II, 26.3% belonged to Class III, 25.5% to Class IV and 9.1% belonged to Class V.

To find out the prevalence of hypertension BP percentile charts were constructed for each of the age and sex in the study population. As per NHBPEP 4<sup>th</sup> Report<sup>22</sup>, those having BP more than 95<sup>th</sup> percentile were considered as hypertensives. There was a variation in the 95<sup>th</sup> percentile cut off values used for defining hypertension in our study and some other studies. For example the value in our study for 17 years of age was 136/86 mmHg whereas Soudarssanane MB et al.<sup>33</sup> reported 127.4/87 mmHg and Taksande A et al.<sup>36</sup> reported 130/90 mmHg. These variations might be due to the number of participants in each age group. This necessitates the need for formulation of a BP percentile chart for adolescents and children for the whole country so that the comparison can be accurate.

The mean SBP and DBP in our study population were found to be 111.96 mmHg and 69.76 mmHg respectively. According to the study findings, mean SBP among boys (112.48 mmHg) was higher than girls (111.48 mmHg) and mean DBP (70.16 mmHg) was higher among girls when compared to boys (68.86mmHg).

Durrani AM et al.<sup>31</sup> has reported a similar finding among school children in Aligarh. But Jaddou HY et al.<sup>24</sup>, Nur N et al.<sup>26</sup> and Soudarssanane MB et al.<sup>33</sup> have reported that both mean SBP and mean DBP were higher among boys.

## **7.1 Prevalence of Hypertension**

Among the study group 67 (7.17%) were identified as hypertensives. And among boys the prevalence was found to be 7.2% which was slightly higher than girls (7.14%). Anjana et al. has reported a similar prevalence (7.5%) among school children in Punjab and studies done elsewhere by Lurbe et al.<sup>27</sup> (7.6%) and Silva MAM et al.<sup>28</sup> (7.7%) have also reported similar prevalence among adolescents.

Soudarssanane MB et al.<sup>33</sup> (8.5%) and Durrani AM et al.<sup>31</sup> (9.4%) have reported a slightly higher prevalence of hypertension among school children. Taksande A et al.<sup>36</sup> has reported 5.75% prevalence in rural Maharashtra which was lower than our result. Similar prevalence around 5-8% has been reported by Abolfotouh et al.<sup>7</sup> (5.7%) and Vlainac et al.<sup>30</sup> (5%) in other countries also. These slight variations in prevalence could be due to the differences in measurement techniques and difference in the number of participants in the studies.

Verma M et al.<sup>34</sup> has reported a very low prevalence (1.1%). Similarly prevalence less than 5% were reported by Jaddau et al.<sup>24</sup> (3.7%), Hansen ML et al.<sup>25</sup> (3.6%) and Sorof MJ et al.(4.5%).<sup>29</sup> Lower prevalence of hypertension reported in these studies might be due to various reasons. For example in our study BP was measured twice on the same day, whereas in some studies BP was measured on separate occasions<sup>34</sup>. But for epidemiological studies two readings on the same day was considered appropriate.<sup>12</sup> Secondly, the studies which showed very low prevalence were mostly using definitions other than BP >95<sup>th</sup> percentile to label as hypertension.



Chadha et al.<sup>10</sup> reported 11.5% prevalence of hypertension among the school children in Delhi. The higher prevalence rate observed in the study could be attributed to the difference in the age group selected for their study (5-14 years) and our study. They have conducted the study in urban Delhi whereas ours was a rural school based study. The major reason for these differences in prevalence of hypertension could be due to varied age groups used by different studies. Apart from that, the differences in definition of hypertension, variations in measurements and also rural-urban variations may play a major role.

Among the hypertensives in the study population Isolated Systolic hypertension was more common (43.28%). Isolated Diastolic Hypertension was seen among 31.34% and the remaining have both. Soudarssanane MB et al.<sup>33</sup> has also reported Isolated Systolic Hypertension to be the most common (38.6%). Isolated systolic Hypertension is a strong predictor of cardiovascular diseases and the higher prevalence of it among the adolescents needs special attention.

## **7.2 Prevalence of Overweight and Obesity**

The prevalence of overweight was found to be 8.89% and 4.4% were obese. Overall among the study group 124 (13.28%) were identified as overweight/obese. And the mean BMI was 17.78 (SD-3.14). Prevalence was slightly higher among girls (13.44%) when compared to boys (13.10%). Also the mean BMI was higher among girls (18.58) than boys (16.95). The mean BMI increases with age among boys from 16.07 in 14 years to 17.80 in 17 years. Among girls the mean BMI increases from 17.49 at 14 years to 19.76 at 17 years of age. Khan MI et al.<sup>37</sup> has reported 20.3% prevalence of overweight/obesity. This alarming increase in overweight & obesity depicts the effect of rapid urbanization of rural areas which has resulted in lifestyle changes mainly – changes in diet pattern and decreased physical activity.

### **7.3 Correlation with Age, Height, Weight and BMI**

In our study there was a significant positive correlation between SBP and DBP with age ( $r=0.208$  for SBP;  $r=0.157$  for DBP), height ( $r=0.350$  for SBP;  $r=0.131$  for DBP), weight ( $r=0.533$  for SBP;  $r=0.304$  for DBP) and BMI ( $r=0.428$  for SBP;  $r=0.291$  for DBP). Both SBP and DBP had a significant positive correlation with all the variables in boys. Among girls except for age and SBP others had a significant positive correlation with both SBP and DBP.

Taksande A et al.<sup>36</sup>, Durrani AM et al.<sup>31</sup> and Soudarssanane MB et al.<sup>33</sup> have all reported a similar positive correlation between SBP and DBP with the above variables. These findings show that just like height, weight and BMI, blood pressure is also increasing with age as a part of biological maturation.

### **7.4 Overweight & Obesity and Hypertension**

There was a significant association between hypertension and overweight & obesity in the study population. Prevalence of hypertension among them was 25% in contrast to the prevalence among those with normal BMI (4.4%). Raj M et al.<sup>46</sup> has reported 17.34% prevalence of hypertension among overweight. Similar findings were reported by Moore WE et al.<sup>41</sup>, Paradis G et al.<sup>42</sup>, He Q et al.<sup>43</sup> and Burgos et al.<sup>11</sup> in various countries.

The Bogalusa Heart study found that central body fat was well correlated with elevated BP among adolescents while peripheral fat has no correlation with BP.<sup>44</sup> These findings confirm obesity as a major determinant of elevated BP at this age. Along with that obesity during young age is a risk factor for adult obesity, cardiovascular diseases including hypertension and dyslipidemia. So, overweight and obesity needs to be tackled at this stage itself since it acts as a major contributor of hypertension not only during adolescence but also among adults.

## **7.5 Family History and Hypertension**

In our study family history was identified as a significant risk factor for hypertension in the study group. Among the study participants the prevalence of hypertension was 11.5% among those with family history against 6.4% among those without family history. Studies by Verma M et al <sup>48</sup>, Goel R et al <sup>32</sup>, Sharma et al <sup>12</sup>. and Falkner F et al <sup>23</sup>. have identified a strong association between hypertension among adolescents and family history. It becomes clear that those who have family history are at a higher risk of developing hypertension.

## **7.6 Other Risk factors**

Apart from Overweight/obesity and family history, other factors (socio demographic factors, diet pattern and physical activity) were found to have no association with hypertension in this study population. Khan MI et al. <sup>37</sup> reported that there was no association between dietary factors (added salt and junk foods) and hypertension. Soudarssanane MB et al<sup>33</sup> has also found out there was no effect of diet and physical activity on hypertension.

He FJ et al<sup>49</sup> in their meta analysis found that reduction in salt intake resulted in significant reductions in both SBP and DBP even among children. But the result from our study shows that there was no association between salt intake and hypertension in our study population. Parker ED et al has reported that those who were physically active had a lesser risk of incident hypertension.<sup>50</sup> So, in order to decrease the risk of hypertension and other non communicable diseases in the future a person has to be physically active.

It becomes clear from this study that hypertension is a significant problem even among adolescents in rural areas. The study also shows that overweight/obesity and family history of hypertension are significant risk factors in the study population.

# SUMMARY

## 8. SUMMARY

A cross sectional study was done to find out the prevalence of hypertension and its risk factors such as obesity, family history, diet pattern and physical activity among 934 school students aged 14-17 years studying in selected four schools in rural areas of Kancheepuram district.

A pre tested questionnaire was used to collect information regarding the socio demographic details, diet pattern and physical activity. Height, weight and blood pressure were also measured. Those who were having BP >95<sup>th</sup> percentile for their age and sex were considered as hypertensives. And those with BMI between 85<sup>th</sup> percentile to 95<sup>th</sup> percentile were taken as overweight and >95<sup>th</sup> percentile were taken as obese.

The study revealed the following findings:

- In our study population 67 (7.17%) were found to have hypertension. Prevalence was slightly higher among boys (7.2%) when compared to girls (7.14%).
- Of the hypertensives 43.28% were found to have Isolated Systolic Hypertension, 31.34% were having Isolated Diastolic Hypertension and the remaining (25.37%) have both systolic and diastolic hypertension.
- The mean SBP and DBP in the study population were found to be 111.96 mmHg and 69.76 mmHg respectively. The mean SBP was found to be higher among boys (112.48 mmHg) in comparison to girls (111.48 mmHg). In contrast the mean DBP (70.16 mmHg) was found to be higher among girls when compared to boys (68.86mmHg).

- Among the study population 124 (13.28%) were found to be overweight/obese. When compared to boys (13.10%), girls (13.44%) have slightly higher prevalence. The mean BMI was also found to be higher among girls (18.58) than boys (16.95).
- There was a significant positive correlation between SBP and DBP with age, height, weight and BMI in the study. Among boys all the above variables were having significant positive correlation with SBP and DBP. In girls except for age and SBP other variables had a significant positive correlation with both SBP and DBP.
- Family history of chronic diseases like hypertension, diabetes mellitus and CAD was found to be a significant risk factor for hypertension. Prevalence was found to be higher among those with family history when compared to others without such history (11.5% vs. 6.4%).
- In our study overweight & obesity turned out to be a significant risk factor for hypertension in the study group. Hypertension was highly prevalent among overweight/ obese when compared to those with normal BMI (25% vs. 4.4%).
- Other factors such as diet pattern and physical activity were found to have no significant association with hypertension in the study group. Socio demographic variables were also shown to have no significant association with hypertension.

This study establishes the fact that hypertension is prevalent among adolescents in rural areas also mainly due to increase in obesity. This requires urgent attention failing which the burden of hypertension in adolescents will result in serious consequences such as increased incidence of cardiovascular diseases when they become adults.

# **LIMITATIONS**

## **9. LIMITATIONS**

- The age group studied was only between 14-17 years. According to WHO the adolescent age group is 10-19 years. So the results may not be generalizable to the entire adolescent age group.
- The study was done in selected schools in Kancheepuram district. So it may not represent all the adolescents in the whole district.
- Those adolescents who were not going to schools were not included in the study.
- Height adjusted Blood Pressure values were not used in the study.
- Assessment of dietary intake and physical activity in the study required recall of diet and physical activity pattern. There may be recall bias due to this approach.



# **RECOMMENDATIONS**

## **10. RECOMMENDATIONS**

The results of the study revealed that hypertension is prevalent among adolescents in rural areas also. The following are the recommendations from the findings of the study:

- There is a need for school based screening programme for primary and secondary prevention of hypertension among adolescent school students. This can be included in the ongoing school health programme being run through the Primary Health Centres on every Thursday.
- Standard Blood Pressure percentile charts for Indian adolescents should be prepared so as to have uniformity in classification of hypertension.
- The problem of overweight and obesity among adolescents is increasing alarmingly and it also acts as a significant risk factor for hypertension among them. So they have to be identified and managed accordingly.
- Since family history of chronic diseases like hypertension, diabetes mellitus and CAD was found to be a risk factor, those with positive history to be identified and should be periodically examined.
- Importance of diet, physical activity and other life style changes for the prevention of non communicable diseases can be included in the school syllabus.
- Further larger multi centric community based studies are needed to assess the burden of hypertension among adolescents.

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# **ANNEXURES**

# **ANNEXURE I**

## **INFORMATION SHEET**

**Title of the Dissertation:**

**A Cross-sectional study on the prevalence of hypertension among school students aged 14 to 17 years in rural areas of Kancheepuram district, Tamil Nadu, 2011.**

The purpose of the study is to find out the prevalence of Hypertension among rural adolescent school students in Kancheepuram.

Hypertension in the young is increasing in prevalence. Hypertension plays a major role in the development of ischemic heart disease, cerebrovascular disease, cardiac and renal failure. These complications can be prevented by simple life style modifications.

We request you to permit your son/daughter to participate in the study.

The privacy of your son/daughter in the research will be maintained throughout the study. In the event of any publication or presentation resulting from the research, no personally identifiable information will be shared.

Taking part in this study is voluntary. You are free to decide whether to allow your son/daughter to participate in this study or to withdraw at any time; your decision will not result in any loss of benefits to which they are otherwise entitled.

The results of this study may be intimated to you at the end of the study period or during the study if anything is found abnormal which may aid in the management or treatment.

**தகவல் தாள்**

**காஞ்சிபுரம் மாவட்டத்தை சார்ந்த 14-17 வயதிற்குட்பட்ட கிராமப்புற  
வளரிளம் பருவ பள்ளி மாணவர்களிடையே நிலவும் உயர் இரத்த  
அழுத்தம் கண்டறியும் ஆய்வு**

காஞ்சிபுரம் மாவட்டத்தை சார்ந்த 14-17 வயதிற்குட்பட்ட கிராமப்புற வளரிளம் பருவ பள்ளி மாணவர்களிடையே நிலவும் உயர் இரத்த அழுத்தம் கண்டறிவதே இந்த ஆராய்ச்சியின் நோக்கமாகும்.

இக்காலத்தில் உயர் இரத்த அழுத்தம் வளரிளம் வயதினரிடையே பரவலாக காணப்படுகிறது. இதனை ஆரம்ப நிலையிலேயே கண்டறிந்து சில நல்ல பழக்கவழக்கங்களை மேற்கொள்வதன் மூலம் உயர் இரத்த அழுத்தத்தினால் ஏற்படும் பிற்கால விளைவுகளை (மாரடைப்பு, பக்கவாதம் மற்றும் சிறுநீரக பாதிப்பு) எளிதில் தடுக்கலாம்.

தங்கள் மகன்/மகள் இந்த ஆராய்ச்சியில் பங்கேற்க நாங்கள் விரும்புகின்றோம்.

இந்த ஆராய்ச்சியின் முடிவுகளை அல்லது கருத்துக்களை வெளியிடும்போதோ அல்லது ஆராய்ச்சியின் போதோ தங்களது அல்லது தங்கள் மகன்/மகள் பெயரையோ, அடையாளங்களையோ வெளியிடமாட்டோம் என்பதையும் தெரிவித்துக்கொள்கிறோம்.

இந்த ஆராய்ச்சியில் தங்கள் மகன்/மகள் பங்கேற்பது தங்களுடைய விருப்பத்தின்பேரில் தான் இருக்கிறது. மேலும் அவர்கள் எந்நேரமும் இந்த ஆராய்ச்சியிலிருந்து பின்வாங்கலாம் என்பதையும் தெரிவித்துக்கொள்கிறோம்.

இந்த ஆராய்ச்சியின் முடிவுகளை ஆராய்ச்சியின்போதோ அல்லது ஆராய்ச்சியின் முடிவின்போதோ தங்களுக்கு அறிவிக்கப்படும் என்பதையும் தெரிவித்துக்கொள்கிறோம்.

## INFORMED CONSENT FORM

### **Title of the Dissertation:**

**A Cross-sectional study on the prevalence of hypertension among school students aged 14 to 17 years in rural areas of Kancheepuram district, Tamil Nadu, 2011.**

Name of the Participant:

Age/Sex:

Name of the Participant's Parent:

Age/Sex:

Participant ID :

Date:

- (1) I have been explained in detail about the study and its procedure. I confirm that I had completely understood the study and have had the opportunity to ask questions.
- (2) I understand that my son/daughter's participation in the study is voluntary and that my son/daughter is free to withdraw at any time, without giving any reason, without their medical care or legal rights being affected.
- (3) I understand that the principal investigator, others working on the investigator's behalf, the Ethics Committee and the regulatory authorities will not need my permission to look at my son/daughter's health records both in respect of the current study and any further research that may be conducted in relation to it, even if they withdraw from the trial. I agree to this access. However I understand that my identity or my son/daughter's identity will not be revealed in any information released to third parties or published.
- (4) I agree not to restrict the use of any data or results that arise from this study provided such a use is only for scientific purpose(s).
- (5) I agree to my son/daughter taking part in the above study.

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Name of the Participant's Parent

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Signature or thumb impression  
of Participant's Parent

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Name of the investigator

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Signature of the investigator

**ஒப்புதல் படிவம்**

**காஞ்சிபுரம் மாவட்டத்தை சார்ந்த 14-17 வயதிற்குட்பட்ட கிராமப்புற  
வளரிளம் பருவ பள்ளி மாணவர்களிடையே நிலவும் உயர் இரத்த  
அழுத்தம் கண்டறியும் ஆய்வு**

பங்கேற்பவர் பெயர் : வயது/ பாலினம் :  
பங்கேற்பவர் பெற்றோர் பெயர் : வயது/ பாலினம் :  
ஆராய்ச்சி சேர்க்கை எண் : தேதி:

இந்த ஆராய்ச்சியின் விவரங்களைக் கொண்ட தகவல் தாளைப் பெற்றுக்கொண்டேன்.

இந்த ஆராய்ச்சியின் விவரங்களும் அதன் நோக்கமும் முழுமையாக எனக்கு தெளிவாக விளக்கப்பட்டது.

எனக்கு விளக்கப்பட்ட விஷயங்களை நான் புரிந்துகொண்டு எனது சம்மதத்தை தெரிவிக்கிறேன்.

இந்த ஆராய்ச்சியில் பிறிரின் நிர்பந்தமின்றி என் சொந்த விருப்பத்தின்பேரில்தான் எனது மகன்/மகள் பங்கு பெறுகிறார்கள். இந்த ஆராய்ச்சியில் இருந்து எனது மகன்/மகள் எந்நேரமும் பின் வாங்கலாம் என்பதையும் அதனால் எந்த பாதிப்பும் ஏற்படாது என்பதையும் நான் புரிந்துகொண்டேன்.

நான் என்னுடைய சுய நினைவுடனும் மற்றும் முழு சுதந்திரத்துடனும் இந்த மருத்துவ ஆராய்ச்சியில் என் மகன்/மகளை சேர்த்துக்கொள்ள சம்மதிக்கிறேன்.

ஆராய்ச்சியாளர் மற்றும் அவரைச் சாரந்தவர்களோ, நெறிமுறைக்குழு உறுப்பினர்களோ எனது மகன்/மகள் இந்த ஆராய்ச்சியில் இருந்து விலகினாலும் என்னுடைய அனுமதியின்றி அவர்களது உடல்நிலை குறித்த தகவல்களை இந்த ஆராய்ச்சிக்கோ இது தொடர்பான வேறு ஆராய்ச்சிகளுக்கோ பயன்படுத்திக்கொள்ள முடியும் என்று புரிந்து கொண்டு சம்மதம் அளிக்கிறேன். ஆனாலும் என்னுடைய மகன்/மகள் அடையாளம் வெளியிடப்படமாட்டாது என்று புரிந்துகொள்கிறேன்.

இந்த ஆராய்ச்சியின் தகவல்களையும் முடிவுகளையும் அறிவியல் நோக்கத்திற்காக பயன்படுத்துவதற்கு நான் அனுமதிக்கிறேன். நான் எனது மகன்/மகள் இந்த ஆராய்ச்சியில் பங்குபெற சம்மதிக்கிறேன்.

பங்கேற்பவரின் பெற்றோர் பெயர் : பங்கேற்பவரின் பெற்றோர் கையொப்பம்  
(அல்லது) கட்டைவிரல் ரேகை

ஆய்வாளர் பெயர் : ஆய்வாளரின் கையொப்பம்

இடம் : தேதி

## **ANNEXURE II**

### **INTRODUCTION TO PARTICIPANTS**

- This Study is completely confidential. We are interested in finding out the prevalence of hypertension among adolescent school students.
- If you have any question or if you do not understand, please let us know we are here to help you.
- All the information you give us will be private. Whether you answer the questions or not your grade will not be affected.
- If you decide not to participate, your teacher will provide you with some other activity during this class. However, we really need your help to keep adolescent people healthy.
- We hope that you will help us to complete this survey.



## QUESTIONNAIRE-ENGLISH

**Participant ID:**

### **PART I: SOCIO DEMOGRAPHIC PROFILE:**

1. Name of the student :

2. Age :

3. Sex :

4. Religion :

5. Total income of the family :

6. Total Members of the family :

7. Socio economic class :

8. Family History :

<b>Disease</b>	<b>Father</b>	<b>Mother</b>	<b>Siblings</b>
Hypertension			
Ischemic heart disease			
Diabetes mellitus			
Stroke			

## **PART II - DIET PATTERN:**

9. During the past 7 days, how frequently you had fruits?
  - a. Daily
  - b. Two or more days a week
  - c. Once a week
  - d. Didn't take
10. During the past 7 days, how frequently you had vegetables?
  - a. Daily
  - b. Two or more days a week
  - c. Once a week
  - d. Didn't take
11. During the past 7 days, how frequently you had non vegetarian foods?
  - a. Daily
  - b. Two or more days a week
  - c. Once a week
  - d. Didn't take
12. During the past 7 days, how frequently you had foods like samosa/bajji/noodles/ice creams/chips-lays, kurkure, etc.?
  - a. Daily
  - b. Two or more days a week
  - c. Once a week
  - d. Didn't take

13. What type of oil is used for cooking?

- a. coconut oil
- b. ground nut oil
- c. gingelly oil
- d. palm oil
- e. refined sunflower oil
- f. others

14. How much salt is used in your family in the last month?

- a. 1kg
- b. 2kg
- c. 3kg
- d. 4kg

**PART III- PHYSICAL ACTIVITY:**

15. How will you reach school daily?

- a. Cycle
- b. Walking
- c. Bus/van/auto
- d. Motorcycle

16. How often do you play games like kabadi/cricket/volley ball/basket ball, etc. each week?

- a. Daily
- b. Two or more days a week
- c. Once a week
- d. Don't play

17. How many hours you will play outdoor games per day?

- a. <1 hr
- b. 1-2
- c. hrs
- d. >2 hrs
- e. Don't play

18. How many hours you will watch TV daily?

- a. <1 hr
- b. 1-2 hrs
- c. >2 hrs
- d. Don't watch

**PART IV- MEASUREMENTS:**

19. Height :

20. Weight :

21. BMI :

22. Blood Pressure :

1<sup>st</sup> reading :

2<sup>nd</sup> reading : Average :

**Thanks for your co-operation**

## பங்கேற்பாளர்களுக்கான தகவல்

- இந்த ஆய்வு முற்றிலும் இரகசியமானது. வளர்இளம்பருவ பள்ளி மாணவர்கள் மத்தியில் நிலவும் உயர் இரத்த அழுத்தம் கண்டறியும் நோக்கில் இந்த ஆய்வு மேற் கொள்ளப்படுகிறது.
- உங்களுக்கு ஏதேனும் சந்தேகங்கள் இருப்பின் எங்களிடம் தெரிவிக்கவும் .
- உங்கள் பதில் எந்த நேரத்திலும் யாருக்கும் தெரியபடுத்தப்படமாட்டாது.
- நீங்கள் அளிக்கும் பதிலால் தங்களின் தரம் பாதிக்கப்பட மாட்டாது.
- நீங்கள் இந்த ஆய்வில் கலந்துக் கொள்ளக் கூடாது என முடிவு செய்தால் உங்கள் ஆசிரியர் வேறு ஏதேனும் செயல்களை உங்களுக்கு அளிப்பார்கள். எனினும் வளர் இளம் பருவத்தினரின் நலனுக்காக உங்களின் உதவி தேவைப்படுகிறது.
- நாங்கள் இந்த ஆய்வை முடிக்க நீங்கள் ஒத்துழைப்பீர்கள் என்று நம்புகிறோம்.

## வினாப்பட்டி

பங்கேற்பாளரின் அடையாள எண்.

### பகுதி 1

1. மாணவரின் பெயர் :
2. வயது :
3. பாலினம் :
4. மதம் :
5. குடும்பத்தின் மொத்த மாத வருமானம் :
6. குடும்ப மொத்த உறுப்பினர்கள் :
7. சமூக பொருளாதாரப் பிரிவு :
8. தாய் தந்தை உடன் பிறந்தோரின் கீழ்க்காணும் நோய்கள் பற்றிய விவரம்:

நோய்	தந்தை	தாய்	உடன் பிறந்தோர்
உயர் இரத்த அழுத்தம்			
இருதய நோய்			
சர்க்கரை நோய்			
பக்கவாத நோய்			

## பகுதி 2 உணவுமுறை

9. கடந்த 7 நாட்களில், எத்தனை முறை பழவகைகள் எடுத்துக் கொண்டாய்?
- அ. தினமும்  
ஆ. 2 நாட்கள் (அ) அதற்கு மேல்  
இ. வாரம் ஒரு முறை  
ஈ. எடுத்துக் கொள்ளவில்லை
10. கடந்த 7 நாட்களில், எத்தனை முறை காய்கறிகள் எடுத்துக் கொண்டாய்?
- அ. தினமும்  
ஆ. 2 நாட்கள் (அ) அதற்கு மேல்  
இ. வாரம் ஒரு முறை  
ஈ. எடுத்துக் கொள்ளவில்லை
11. கடந்த 7 நாட்களில், எத்தனை முறை மாமிசவகைகள் எடுத்துக் கொண்டாய்?
- அ. தினமும்  
ஆ. 2 நாட்கள் (அ) அதற்கு மேல்  
இ. வாரம் ஒரு முறை  
ஈ. எடுத்துக் கொள்ளவில்லை
12. கடந்த 7 நாட்களில், எத்தனை முறை சமோசா/பஜ்ஜி/நூடுல்ஸ்/ஐஸ்கிரிம்/சிப்ஸ்-லேஸ், குர்குரே போன்ற உணவுகளை எடுத்துக் கொண்டாய்?
- அ. தினமும்  
ஆ. 2 நாட்கள் (அ) மேல்  
இ. வாரம் ஒரு முறை  
ஈ. எடுத்துக் கொள்ளவில்லை
13. எந்த வகை எண்ணெய் வீட்டில் உணவு தயாரிக்க பயன்படுத்துகிறீர்கள்?
- அ. தேங்காய் எண்ணெய்  
ஆ. கடலை எண்ணெய்  
இ. நல்லெண்ணெய்  
ஈ. பாமாயில்  
உ. சூரியகாந்தி எண்ணெய்  
ஊ. மற்றவை
14. உங்கள் குடும்பத்தில் கடந்த ஒரு மாதத்திற்கு எத்தனை கிலோ உப்பு பயன்படுத்தினீர்கள்?
- அ. 1 கிலோ  
ஆ. 2 கிலோ  
இ. 3 கிலோ  
ஈ. 4 கிலோ

### பகுதி 3 - உடல் செயல்பாடுகள்

15. தினமும் பள்ளிக்கு எவ்வாறு செல்வாய்?

- அ. சைக்கிள்
- ஆ. கால் நடையாக
- இ. பஸ்/ஆட்டோ/வேன்
- ஈ. மோட்டர் சைக்கிள்

16. கபடி/கிரிக்கெட்/வாலிபால்/ கூடைபந்து போன்ற விளையாட்டுகளை வாரத்தில் எத்தனை முறை விளையாடுவாய்?

- அ. தினமும்
- ஆ. 2 நாட்கள் (அ) அதற்கு மேல்
- இ. வாரம் ஒரு முறை
- ஈ. விளையாடுவது இல்லை

17. மேற்கண்ட விளையாட்டுகளை எத்தனை மணி நேரம் விளையாடுவாய்?

- அ. 1 மணி நேரத்திற்கும் குறைவாக
- ஆ. 1 முதல் 2 மணி நேரம் வரை
- இ. 2 மணி நேரத்திற்கும் மேல்
- ஈ. விளையாடுவது இல்லை

18. தினமும் எத்தனை மணி நேரம் தொலைகாட்சி பார்ப்பாய்?

- அ. 1 மணி நேரத்திற்கும் குறைவாக
- ஆ. 1 முதல் 2 மணி நேரம் வரை
- இ. 2 மணி நேரத்திற்கும் மேல்
- ஈ. பார்ப்பது இல்லை

### பகுதி 4 அளவுகள்:

19. உயரம் :

20. எடை :

21. பி.எம்.ஐ :

22. இரத்த அழுத்தம் : 1.

2.

சராசரி :

தங்களின் ஒத்துழைப்பிற்கு நன்றி.



### **ANNEXURE -III**

#### **SOCIO ECONOMIC CLASS BASED ON MODIFIED B.G. PRASAD'S CLASSIFICATION**

The calculation for socio economic class based on Modified BG Prasad's classification was done as follows:

Consumer Price Index for rural laborers in Tamilnadu in the month of August, 2011 = 574

Multiplication factor= Value of Consumer Price Index  $\times 4.93/100=28.3$

Modified BG Prasad's classification for August, 2011= Per capita income in 1961 $\times$ Multiplication factor

<b>CLASS</b>	<b>OLD CLASSIFICATION 1961</b>	<b>FOR AUGUST 2011</b>
I	100 & above	2830 &above
II	50-99	1415-2829
III	30-49	850-1414
IV	15-29	425-849
V	<15	<425

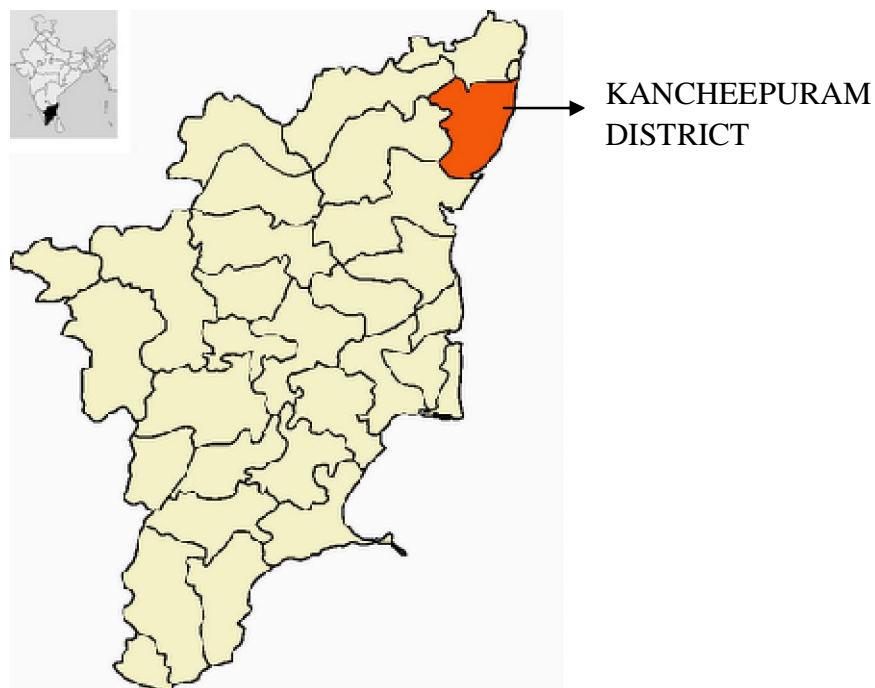
**ANNEXURE IV**  
**LIST OF SCHOOLS IN KANCHEEPURAM DISTRICT**

**CHENGALPATTU EDUCATIONAL DISTRICT**

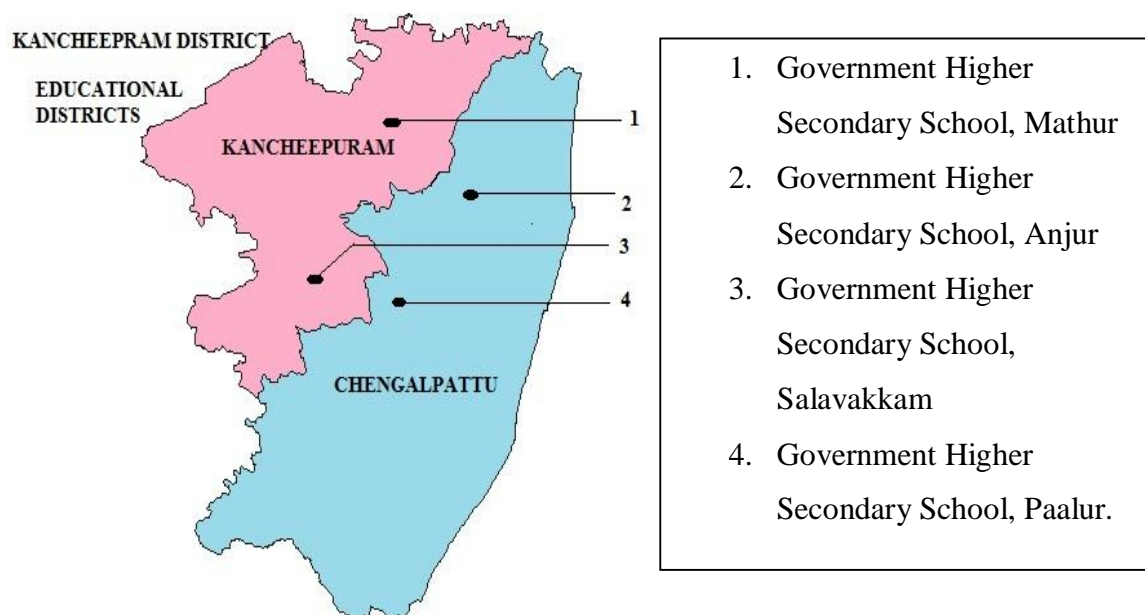
SNo.	Name of the School	Sno.	Name of the School
1	Government Higher secondary School, Thirukalukundram(M)	65	Ramakrishna Higher secondary School, Chengalpattu(F)
2	Government Higher secondary School, Thiruporur	66	St. Marys Higher secondary School, Chengalpattu(F)
3	Government Higher secondary School, Kadapakkam	67	St. Theresa Higher secondary School, Pallavaram
4	Government Higher secondary School, Cheyyur	68	Christ King Higher secondary School, Tambaram
5	Government Higher secondary School, Nandivaram	69	St. Helen Higher secondary School, Mount
6	Government Higher secondary School, Thirukalukundram(F)	70	St. Joseph Higher secondary School, Vettuvankani
7	Government Higher secondary School, Pallavaram	71	St. Joseph Higher secondary School, kovalam
8	Government Higher secondary School, Nanganallur(M)	72	Alison Higher secondary School, Chengalpattu
9	Government Higher secondary School, Peeranganarai	73	Valluvar Kurukulam Higher secondary School, Tambaram
10	Government Higher secondary School, Karunkuzhi	74	Sri Venkateswara Higher secondary School, Madipakkam
11	Government Higher secondary School, Pallikaranai	75	YMCA Higher secondary School, Kottivakkam
12	Government Higher secondary School, PV Kalathur	75	Little Flower Higher secondary School, Cheyyur
13	Government Higher secondary School, Acharapakkam (M)	76	Doctor Arulappan Higher secondary School, Neerpaer
14	Government Higher secondary School, Acharapakkam (F)	77	Government Municipality Higher Secondary School, Jameen Pallavaram
15	Government Higher secondary School, Koovathur	78	Government Municipality Higher Secondary School, Selaiyur
16	Government Higher secondary School, Madurantakam	79	Government Municipality Higher Secondary School, Jameen Royapettah
17	Government Higher secondary School, Padupattinam		
18	Government Higher secondary School, Orathi		<b>KANCHEEPURAM EDUCATIONAL DISTRICT</b>
19	Government Higher secondary School, Chromepet(M)		
20	Government Higher secondary School, Paalur	1	Government Higher secondary School, Avalur
21	Government Higher secondary School, Chengalpattu(F)	2	Government Higher secondary School, Arapakkam
22	Government Higher secondary School, Anakaputtur	3	Government Higher secondary School, Ayyanpettai
23	Government Higher secondary School, Chromepet(F)	4	Government Higher secondary School, Uthiramerur
24	Government Higher secondary School, Nanganallur(F)	5	Government Higher secondary School, Manampathi
25	Government Higher secondary School, Sotupakkam	6	Government Higher secondary School, Perunagar
26	Government Higher secondary School, Sadurangapattinam	7	Government Higher secondary School, Salavakkam
27	Government Higher secondary School, Manampathy	8	Government Higher secondary School, Nayakanpettai
28	Government Higher secondary School, Elapakkam	9	Government Higher secondary School, Walajabad(B)
29	Government Higher secondary School, Ananthamangalam	10	Government Higher secondary School, Thirupukuzhi
30	Government Higher secondary School, Mamallapuram	11	Government Higher secondary School, Sriperumpudhur
31	Government Higher secondary School, Nemmeli	12	Government Higher secondary School, Padappai
32	Government Higher secondary School, Sholinganalur	13	Government Higher secondary School, Somangalam
33	Government Higher secondary School, Nandivaram (F)	14	Government Higher secondary School, Kovur
34	Government Higher secondary School, Singaperumal Koil	15	Government Higher secondary School, Kundrathur (B)
35	Government Higher secondary School, Mambakkam	16	Government Higher secondary School, Uthiramerur (G)
36	Government Higher secondary School, Maraimalai nagar	17	Government Higher secondary School, Walajabad(G)
37	Government Higher secondary School, Choonambedu	18	Government Higher secondary School, Big Kancheepuram (G)
38	Government Higher secondary School, L Endathur	19	Government Higher secondary School, Small Kancheepuram (G)
39	Government Higher secondary School, Nellikuppam	20	Government Higher secondary School, Ekanampettai(G)
40	Government Higher secondary School, Madambakkam	21	Government Higher secondary School, Maduramangalam
41	Government Higher secondary School, Thozhupedu	22	Government Higher secondary School, Kaliyampoondi
42	Government Higher secondary School, Kovilambakkam	23	Government Higher secondary School, Thamal
43	Government Higher secondary School, Anjur	24	Government Higher secondary School, Ayyangarkulam
44	Government Higher secondary School, Kelambakkam	25	Government Higher secondary School, Mathur
45	Government Higher secondary School, Puzhuthivakkam	26	Government Higher secondary School, Orakattupattai
46	Government Higher secondary School, Thiruvathur	27	Government Higher secondary School, Kundrathur (G)
47	Government Higher secondary School, Sembakkam	28	Government Higher secondary School, Molachur
48	Government Higher secondary School, SCSM – Padalam	29	Government Higher secondary School, Sriperumpudhur (G)
49	Government Higher secondary School, Moovaramsampet	30	Government Higher secondary School, Banrutti
50	Government Higher secondary School, Kayapakkam	31	Government Higher secondary School, Pullalur
51	Government Higher secondary School, Okkiyam Thuraipakam	32	Government Higher secondary School, Govindavadi
52	Government Higher secondary School, Morapakkam	33	KMS Government Higher secondary School, Kanchipuram
53	Government Higher secondary School, Thiruporur(F)	34	Government Higher secondary School, Kammalampoondi
54	Government Higher secondary School, Kannaki Nagar	35	Government Higher secondary School, Ayyapanthangal
55	Government Higher secondary School, Perungalathur	36	Dr. BSS Municipality Higher secondary School, Kanchipuram
56	St. Joseph Higher secondary School, Chengalpattu	37	CSM Higher secondary School, Pillayarpalayam
57	St. Columbus Higher secondary School, Chengalpattu	38	Rani Annadurai Higher secondary School, Kanchipuram
58	Hindu Higher secondary School, Madurantakam	39	Pachaiappan Higher secondary School, Kanchipuram
59	AJS Nidhi Higher secondary School, Alandur	40	Anderson Higher secondary School, Kanchipuram
60	Corley Higher secondary School, Tambaram	41	WTM Higher secondary School, Walajabad
61	Chennai Sevasadhan Higher secondary School, Tambaram	42	SSKV Higher secondary School, Kanchipuram
62	St. Thomas Mount Higher secondary School, Mount	43	Mary Axelium, Higher secondary School, Kanchipuram
63	JG National Higher secondary School, Tambaram	44	Little Flower Higher secondary School, Therasapuram
64	Ramakrishna Higher secondary School, Chengalpattu(M)	45	Dhandapani Higher secondary School, Kanchipuram

## ANNEXURE-V

### MAP-KANCHEEPURAM DISTRICT



### KANCHEEPURAM EDUCATIONAL DISTRICT MAP



# ANNEXURE VI

## KEY TO MASTER CHART

Variable	Label	Coding
sno	Serial Number	1,2,etc
age	Age of the participant	14/15/16/17 years
sex	Sex	1=Male 2=Female
religion	Religion	1=Hindu 2=Christian 3=Muslim 4=Others
income	Total income of the family	
members	Total members of the family	
f_hyp	Father having Hypertension	1=Yes 0=No
m_hyp	Mother having Hypertension	1=Yes 0=No
sib_hyp	Siblings having Hypertension	1=Yes 0=No
f_heart	Father having CAD	1=Yes 0=No
m_heart	Mother having CAD	1=Yes 0=No
sib_heart	Siblings having CAD	1=Yes 0=No
f_dm	Father Diabetic	1=Yes 0=No
m_dm	Mother Diabetic	1=Yes 0=No
sib_dm	Siblings Diabetic	1=Yes 0=No
f_stk	Father having Stroke	1=Yes 0=No
m_stk	Mother having Stroke	1=Yes 0=No
sib_stk	Siblings having Stroke	1=Yes 0=No
fruit	Frequency of taking Fruits	1=Daily 2=2 or more days 3=Weekly once 4=Never
veg	Frequency of taking Vegetables	1=Daily 2=2 or more days 3=Weekly once 4=Never
non_veg	Frequency of taking Non Vegetarian foods	1=Daily 2=2 or more days 3=Weekly once 4=Never

junk	Frequency of taking Junk foods	1=Daily 2=2 or more days 3=Weekly once 4=Never
oil	Type of oil used in home	1=Coconut oil 2=Groundnut oil 3=Gingelly oil 4=Palm oil 5=Sunflower oil 6-others
salt	Amount of salt used per month	1=1 kg 2=2 kg 3=3 kg 4=4 kg
go_school	Mode of transport to school	1= Cycle 2=Walk 3=Bus/Auto/Van 4= Motor cycle
games	Frequency of playing outdoor games	1=Daily 2=2 or more days 3=Weekly once 4=Never
g-time	Duration of playing	1=less than 1 hr 2=1to2 hrs 3= more than 2 hrs 4= Don't play
tv_time	Duration of watching TV	1=less than 1 hr 2=1to2 hrs 3= more than 2 hrs 4= Don't watch
ht	Height in metres	
wt	Weight in kg	
sbp	Average Systolic Blood Pressure in mmHg	
dbp	Average Diastolic Blood Pressure in mmHg	

# ANNEXURE VII MASTER CHART

Sl.No	age	sex	religion	income	members	f_hyp	m_hyp	sib_hyp	f_heart	m_heart	sib_heart	f_dm	m_dm	sib_dm	f_stk	m_stk	sib_stk	frut	veg	non_veg	junk_f	oil	salt	go_sc	games	g_time	tv_time	ht	wt	sbp	dbp	
1	14	1	1	2000	3	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	4	4	1	2	2	2	2	1.7	48	102	70	
2	14	1	1	3000	4	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	2	2	2	2	3	1	1.6	44	118	58	
3	14	1	1	5000	4	0	0	0	0	0	0	0	0	0	0	0	0	3	2	3	3	5	1	1	1	3	2	1.6	40	116	62	
4	14	1	1	4000	4	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	2	3	2	1	1	3	3	1.5	48	104	72	
5	14	1	1	3000	4	1	0	0	0	0	0	0	0	0	0	0	0	3	1	3	3	5	1	2	1	3	1	1.6	58	136	72	
6	14	1	1	2000	4	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	3	4	2	3	1	3	3	1.6	37	100	52	
7	14	1	1	7100	6	0	0	0	0	0	0	0	0	0	0	0	0	2	1	2	4	4	2	1	2	3	2	1.4	29	100	60	
8	14	1	2	5000	5	0	0	0	0	0	0	0	0	0	0	0	0	2	2	3	2	5	1	2	2	2	2	1.4	25	90	70	
9	14	1	1	10000	5	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	2	5	2	2	1	2	3	1.4	24	84	60	
10	14	1	1	6000	4	0	0	0	0	0	0	0	0	0	0	0	0	2	1	2	2	5	1	2	1	2	3	1.5	36	100	70	
11	14	1	1	8000	6	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	1	4	2	3	1	3	3	1.3	28	90	70	
12	14	1	1	7000	5	0	0	0	0	0	0	0	0	0	0	0	0	2	1	2	1	5	1	2	1	3	3	1.6	39	100	70	
13	14	1	1	8500	4	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	1	5	1	1	1	2	3	1.5	65	126	80	
14	14	1	1	4000	4	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	1	2	1	2	1	3	3	1.5	34	106	68	
15	14	1	2	2000	4	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	2	5	2	2	2	1	1	1.5	46	112	66	
16	14	1	1	2000	4	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2	4	5	2	1	4	4	2	1.6	43	128	68	
17	14	1	1	6000	5	0	0	0	0	0	0	0	0	0	0	0	0	2	2	3	4	2	2	2	2	3	3	1.4	29	110	60	
18	14	1	2	12000	5	0	0	0	0	0	0	0	0	0	0	0	0	2	2	3	1	5	2	1	1	1	3	1.4	25	88	60	
19	14	1	1	8000	4	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	2	5	1	2	1	2	3	1.4	28	102	56	
20	14	1	1	10000	6	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3	1	5	2	2	2	3	1	1.4	29	100	56	
21	14	1	1	12000	3	0	0	0	0	0	0	0	0	0	0	0	0	1	1	3	2	5	1	2	2	1	1	1.5	26	118	70	
22	14	1	1	4000	4	0	0	0	0	0	0	0	0	0	0	0	0	1	1	3	1	5	1	2	2	1	1	1.4	26	106	62	
23	14	1	1	4500	4	0	0	0	0	0	0	0	0	0	0	0	0	1	1	3	1	5	1	2	2	1	1	1.4	33	90	50	
24	14	1	1	15000	8	0	0	1	0	0	0	0	0	0	0	0	0	2	1	2	1	4	3	2	1	2	1	1.3	26	94	54	
25	14	1	1	3000	4	0	1	0	0	0	0	0	0	0	0	0	0	3	1	2	2	5	1	1	2	2	2	1.4	45	130	100	
26	14	1	1	6000	4	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	2	5	1	2	1	2	2	1.6	36	106	66	
27	14	1	1	4000	4	0	0	0	0	0	0	0	0	0	0	0	0	1	1	3	1	5	1	2	2	1	1	1.4	25	108	62	
28	14	1	2	8000	4	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2	1	5	1	3	2	1	4	1.5	34	106	58	
29	14	1	1	6000	4	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	4	5	1	2	1	1	2	1.8	85	156	72	
30	14	1	1	25000	7	0	0	0	0	0	0	1	0	0	0	0	0	1	2	3	1	3	2	1	1	2	2	1.5	36	124	64	
31	14	1	1	6000	4	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3	3	4	2	2	3	2	2	1.4	22	100	70	
32	14	1	1	5000	7	0	0	0	0	0	0	0	0	0	0	0	0	2	1	2	1	5	2	1	1	3	2	1.5	34	104	68	
33	14	1	1	6000	4	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	1	5	1	2	1	3	3	1.5	35	112	66	
34	14	1	1	7500	4	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	3	5	2	2	1	2	1	1.5	42	112	78	
35	14	1	1	9000	4	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	2	5	1	3	1	2	2	1.5	33	110	70	
36	14	1	1	6000	5	0	0	0	0	0	0	1	1	0	0	0	0	0	2	1	2	2	3	1	1	2	2	1.6	35	86	60	
37	14	1	1	2000	5	0	0	0	0	0	0	0	0	0	0	0	0	4	1	2	1	4	2	3	1	3	4	1.4	33	90	70	
38	14	1	1	5000	4	0	0	0	0	0	0	0	0	0	0	0	0	1	1	3	2	1	4	2	1	1	3	1.4	32	90	60	
39	14	1	1	10000	5	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	1	2	1	3	2	2	1	1.5	33	108	70	
40	14	1	1	3000	5	0	0	0	0	0	0	0	0	0	0	0	0	1	4	2	3	4	1	1	2	3	4	1.4	38	110	80	
41	14	1	1	6500	5	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	2	4	2	3	1	2	3	1.5	35	110	70	
42	14	1	1	5000	4	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	4	2	1	1	3	3	1.5	34	90	60	
43	14	1	1	10000	5	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	2	4	1	1	1	3	3	1.4	27	92	70	
44	14	1	1	8000	6	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	1	5	2	1	3	1	2	1.4	24	90	68	
45	14	1	1	6000	5	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	4	5	1	1	1	2	3	1.4	23	100	60	
46	14	1	1	2000	5	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	3	5	1	2	1	1	1	1.4	25	98	70	
47	14	1	1	6000	5	0	0	0	0	0	0	0	0	0	0	0	0	1	1	3	3	5	2	1	2	3	1	1.4	29	84	58	
48	14	1	1	3000	5	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	3	5	2	1	2	1	1	1.5	40	114	76	
49	14	1	2	4000	5	0	0	0	0	0	0	0	0	0	0	0	0	3	4	3	3	5	1	2	1	2	2	1.4	27	100	80	
50	14	1	1	4500	4	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2	2	2	1	2	1	3	2	1.4	29	98	64	
51	14	1	1	5000	4	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	5	2	1	1	2	3	1.7	45	102	72	
52	14	1	1	4000	4	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	3	5	1	3	1	1	1	1.6	45	122	80	
53	14	1	1	4000	5	0	0	0	0	0	0	0	0	0	0	0	0	2	3	3	2	5	1	3	1	1	3	1.4	27	102	78	
54	14	1	1	3000	4	0	0	0	0	0	0	0	1	0	0	0	0	2	2	4	4	1	2	1	2	1	3	1	1.7	58	136	92
55	14	1	1	6500	5	1	0	0	0	0	0	0	0	0	0	0	0	4	1	2	4	2	1	2	2	2	3	1.7	47	134	64	
56	14	1	1	12000	5	0	0	0	0	0	0	0	0	0	0	0	0	3	3	3	2	5	1	3	3	1	1	1.6	38	110	58	
57	14	1	1	8000	5	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	2	5	1	3	2	1	1	1.5	35	106	56	
58	14	1	1	5000	3	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	4	4	1	2	2	2	2	1.7	48	102	70	
59	14	1	1																													



Sl.No	age	sex	religion	income	members	f_hyp	m_hyp	sib_hyp	f_heart	m_heart	sib_heart	f_dm	m_dm	sib_dm	f_stk	m_stk	sib_stk	frut	veg	non_veg	junk_f	ood	oil	salt	go_sc	hool	games	g_time	tv_time	ht	wt	sbp	dbp
210	14	2	1	10000	5	0	0	0	0	0	0	1	0	0	0	0	0	0	2	1	3	4	5	1	2	3	1	1	1	1.4	55	120	80
211	14	2	1	7000	5	0	0	0	0	0	0	0	0	0	0	0	0	2	1	2	3	3	1	2	1	1	1	1	1.5	46	110	70	
212	14	2	1	12500	4	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	3	5	2	3	3	1	1	1	1.4	31	110	60	
213	14	2	1	9000	4	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	3	2	2	1	2	1	2	1	2	1.5	38	110	70
214	14	2	1	6000	4	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	2	5	2	2	2	1	1	1	1.5	51	128	90	
215	14	2	1	14000	5	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	1	5	1	2	2	1	1	1	1.5	39	100	70	
216	14	2	1	8500	4	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	3	5	2	2	2	1	1	2	1.6	45	124	66	
217	14	2	1	12000	6	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	3	1	2	1	2	1	2	1	2	1.5	42	110	70
218	14	2	1	9000	6	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	2	5	1	2	2	1	2	1	2	1.4	26	90	70
219	14	2	1	4000	4	0	0	0	0	0	0	0	0	0	0	0	0	4	3	3	4	4	1	2	4	4	2	1.5	52	130	80		
220	14	2	1	9000	5	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3	1	5	2	2	3	3	3	1	1.5	40	102	72	
221	14	2	1	14000	6	0	0	0	0	0	0	0	1	0	0	0	0	2	1	3	2	5	2	3	3	1	3	1	1.5	36	92	70	
222	14	2	1	8000	5	0	1	0	0	0	0	0	0	0	0	0	0	2	1	3	4	5	2	2	3	1	2	1	1.6	38	124	58	
223	14	2	1	7500	7	0	0	0	0	0	0	0	0	0	0	0	0	3	2	2	4	5	2	1	2	1	2	1	1.5	39	102	60	
224	14	2	1	15000	5	0	0	0	0	0	0	0	0	0	0	0	0	1	2	4	3	5	1	3	1	1	2	1	1.4	36	100	64	
225	14	2	1	6000	4	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	3	5	1	2	2	1	2	1	1.5	35	122	64	
226	14	2	1	8000	4	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	2	5	2	2	2	2	2	2	1.5	38	106	58	
227	14	2	1	10000	5	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	3	5	2	3	3	1	3	1	1.5	36	100	72	
228	14	2	1	6000	4	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	2	5	1	1	2	1	2	1	1.4	32	104	56	
229	14	2	1	9000	6	0	0	0	0	0	0	0	0	0	0	0	0	2	1	2	1	5	2	3	1	3	1	1	1.5	30	92	56	
230	14	2	1	12000	5	1	0	0	0	0	0	0	0	0	0	0	0	2	1	3	1	5	1	2	2	2	2	2	1.5	40	150	98	
231	14	2	1	7500	4	0	0	0	0	0	0	0	0	0	0	0	0	2	1	1	1	5	1	3	2	1	4	1	1.4	37	124	72	
232	14	2	1	14000	4	0	0	0	0	1	0	0	0	0	0	0	0	3	1	3	4	2	1	1	2	1	2	1	1.4	31	96	56	
233	14	2	3	11000	6	0	0	0	0	0	0	0	0	0	0	0	0	2	1	2	3	5	2	2	2	1	2	1	2	1.6	50	120	60
234	14	2	1	10000	4	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	4	5	1	3	3	1	3	1	1.4	30	98	54	
235	14	2	1	12000	5	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	2	4	2	1	2	3	1	1	1.4	33	86	46	
236	14	2	1	6000	4	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	2	5	1	1	1	1	2	1	1.5	29	100	70	
237	14	2	2	8000	7	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	3	5	2	2	4	4	3	1	1.5	40	90	60	
238	14	2	1	5000	6	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	2	5	2	1	2	2	3	1	1.5	33	110	70	
239	14	2	1	4000	3	0	0	0	0	0	0	0	1	0	0	0	0	0	1	1	2	2	5	1	3	2	1	1	1	1.5	45	120	70
240	14	2	1	8000	4	0	0	0	0	0	0	0	0	0	0	0	0	2	1	1	1	5	1	3	2	1	4	1	1.4	37	124	72	
241	14	2	1	7000	6	0	0	0	0	0	0	1	0	0	0	0	0	1	1	3	2	4	2	2	2	1	2	1	1.6	54	128	70	
242	14	2	1	10000	4	0	0	0	0	1	0	0	0	0	0	0	0	3	1	3	1	5	1	3	3	1	2	1	1.4	33	100	70	
243	14	2	1	15000	6	0	0	0	0	0	0	0	0	0	0	0	0	4	2	4	2	5	2	1	2	1	2	1	1.5	32	92	70	
244	14	2	1	4000	4	0	0	0	0	0	0	0	0	0	0	0	0	2	1	2	3	5	1	1	2	1	1	1	1.5	36	120	80	
245	14	2	1	7000	4	0	0	0	1	0	0	0	0	0	0	0	0	2	3	1	1	5	1	2	2	1	1	1	1.3	32	100	70	
246	14	2	1	12000	4	0	0	0	0	0	0	1	0	0	0	0	0	2	1	3	2	5	1	4	4	4	3	1	1.6	48	104	76	
247	14	2	1	10000	5	0	0	0	0	0	0	0	0	0	0	0	0	2	1	4	1	5	2	2	1	1	3	1	1.6	41	110	74	
248	14	2	1	12500	6	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	3	5	2	1	2	1	1	1	1.4	26	90	70	
249	14	2	1	8000	4	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	2	5	1	1	1	1	3	1	1.6	36	110	74	
250	14	2	2	10000	7	0	0	0	0	0	0	0	0	0	0	0	0	4	2	4	2	5	2	3	4	1	1	1.5	30	90	70		
251	14	2	1	6000	4	0	0	0	0	0	0	0	0	0	0	0	0	2	1	4	3	5	1	1	2	1	4	1	1.5	40	116	76	
252	14	2	1	20000	4	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	2	5	1	3	3	3	3	1	1.4	40	138	80	
253	14	2	1	9000	3	0	1	0	0	0	0	0	0	0	0	0	0	3	1	3	1	4	2	2	2	1	3	1	1.6	46	112	76	
254	14	2	3	14000	5	0	0	0	1	0	0	0	0	0	0	0	0	2	1	3	1	5	1	2	2	1	1	1	1.6	45	124	86	
255	14	2	1	11000	5	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	1	5	2	1	2	1	1	1	1.5	36	96	70	
256	14	2	1	9000	4	0	0	0	0	0	0	0	0	0	0	0	0	2	3	3	1	5	2	2	2	1	1	1	1.6	40	108	78	
257	14	2	1	2000	3	0	0	0	0	0	0	0	0	0	0	0	0	3	2	3	2	3	1	3	4	4	2	1	1.4	49	110	76	
258	14	2	1	9000	4	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	2	5	1	1	3	2	1	1	1.5	39	128	60	
259	14	2	1	14000	3	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	3	5	2	3	2	1	1	1	1.5	33	110	60	
260	14	2	1	10000	5	0	0	0	0	0	0	0	0	0	0	0	0	2	3	3	3	5	2	3	2	1	1	1	1.4	34	100	62	
261	14	2	1	6000	4	0	0	0	0	0	0	0	0	0	0	0	0	2	3	3	3	5	1	1	2	1	1	1	1.5	30	116	66	
262	14	2	1	4000	3	0	0	0	0	0	0	0	0	0	0	0	0	2	3	3	1	5	1	3	2	1	1	1	1.5	44	118	72	
263	14	2	1	8500	4	0	0	0	0	0	0	0	0	0	0	0	0	2	1	2	2	5	1	1	1	2	1	1	1.4	34	90	50	
264	14	2	1	9000	4	0	0	0	0	0	0	0	0	0	0	0	0	1	2	4	2	5	1	3	1	2	1	1	1.4	32	136	74	
265	14	2	1	7000	5	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	4	3	1	1	2	1	1	1	1.6	46	110	76	
266	14	2	1	9500	4																												



Sl.No	age	sex	religion	income	members	f_hyp	m_hyp	sib_hyp	f_heart	m_heart	sib_heart	f_dm	m_dm	sib_dm	f_stk	m_stk	sib_stk	fruit	veg	non_veg	junk_f	veg_ood	oil	salt	go_sc	games	g_time	tv_time	ht	wt	sbp	dbp		
317	15	1	1	6000	4	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	2	3	3	5	2	1	1	2	3	1	1.6	44	108	72
318	15	1	1	7000	4	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	4	5	2	1	2	3	1	1.4	32	100	50		
319	15	1	1	8000	5	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	4	5	2	1	2	3	1	1.5	38	120	60		
320	15	1	1	8500	4	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	2	4	2	1	1	2	3	1.5	35	110	70		
321	15	1	1	6000	5	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	3	5	1	2	3	3	1	1.6	38	106	60		
322	15	1	1	8000	5	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	3	4	1	2	1	3	2	1.6	41	124	76		
323	15	1	1	6000	4	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	3	3	2	1	1	1	3	2	1.4	30	132	64		
324	15	1	1	9000	4	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	2	3	5	2	1	1	3	1	1.4	35	120	58		
325	15	1	1	6000	4	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	5	2	1	1	1	3	2	1.6	39	110	70		
326	15	1	1	9000	5	0	0	0	0	0	0	0	0	0	0	0	0	0	3	2	3	4	3	2	2	1	2	3	1.6	41	100	80		
327	15	1	1	12000	6	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	2	4	2	2	1	3	1	1.5	37	120	80		
328	15	1	1	7500	5	0	0	0	0	0	0	0	0	0	0	0	0	0	3	2	3	1	5	2	2	1	1	1	1.6	60	138	90		
329	15	1	1	10000	5	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	2	5	1	1	2	1	1	1.6	41	128	80		
330	15	1	1	8000	6	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	2	4	2	1	2	3	2	1.5	40	96	58		
331	15	1	1	7000	4	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	2	3	3	1	2	2	3	1	1.5	37	116	60		
332	15	1	1	8000	5	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	2	2	5	2	2	1	3	3	1.6	40	100	60		
333	15	1	1	12000	4	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	3	5	1	2	2	2	1	1.6	39	110	80		
334	15	1	1	6000	5	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	2	2	5	2	2	1	2	1	1.5	32	136	70		
335	15	1	1	8000	6	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2	3	5	2	2	1	1	2	1.5	40	100	70		
336	15	1	1	14000	4	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	3	2	5	1	2	1	1	1	1.5	35	102	80		
337	15	1	1	8000	4	1	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	2	3	2	3	1	2	2	1.7	45	96	50		
338	15	1	1	9000	5	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	2	2	5	1	2	1	2	3	1.5	33	110	80		
339	15	1	1	6000	4	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	3	3	5	1	2	1	3	1	1.6	44	114	64		
340	15	1	1	7500	5	1	0	0	0	0	0	0	0	0	0	0	0	0	1	3	1	1	2	2	3	2	2	3	1.6	58	128	80		
341	15	1	1	12000	5	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	3	1	2	2	2	1	3	3	1.4	30	110	64		
342	15	1	1	8000	6	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	5	2	2	2	1	3	1	1.5	33	118	68		
343	15	1	1	7000	4	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	2	1	5	1	2	1	1	2	1.4	33	110	70		
344	15	1	1	8000	4	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	2	2	5	2	1	2	2	2	1.5	35	100	70		
345	15	1	1	6500	5	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	3	3	2	2	1	1	1	1.4	27	118	70		
346	15	1	2	9000	5	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	2	2	4	2	1	3	2	3	1.4	27	100	70		
347	15	1	1	8000	4	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	2	1	5	1	2	1	2	1	1.4	29	110	79		
348	15	1	2	7500	4	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2	3	4	1	1	1	3	3	1.6	43	102	50		
349	15	1	2	6000	6	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	1	2	2	1	2	1	1	2	1.6	43	102	60		
350	15	1	1	8000	5	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	3	5	1	2	1	1	1	1.4	38	110	50		
351	15	1	1	12000	4	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	2	2	2	2	1	2	2	1.5	35	100	70		
352	15	1	1	20000	6	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	3	2	1	2	1	3	2	1.5	35	118	76		
353	15	1	1	6000	5	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	3	2	5	2	1	1	2	2	1.6	40	120	68		
354	15	1	1	10000	4	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	3	2	5	2	2	1	3	3	1.7	75	146	72		
355	15	1	1	12000	4	0	0	0	0	0	0	0	0	0	0	0	0	0	3	4	2	3	5	2	1	2	2	2	1.6	42	110	50		
356	15	1	1	6000	4	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	3	2	2	2	1	2	3	1	1.6	37	90	60		
357	15	1	1	9500	4	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3	3	5	2	1	1	2	1	1.6	44	108	72		
358	15	1	1	8500	4	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	4	5	2	1	2	3	1	1.4	32	100	50		
359	15	1	1	10000	5	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	4	5	2	1	2	3	1	1.5	38	120	60		
360	15	1	1	8000	4	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	2	4	2	1	1	2	3	1.5	35	110	70		
361	15	1	1	7000	5	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	3	5	1	2	3	3	1	1.6	38	106	60		
362	15	1	1	6000	5	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	3	4	1	2	1	3	2	1.6	41	124	76		
363	15	1	1	9000	4	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	3	3	2	1	1	1	3	2	1.4	30	138	64		
364	15	1	1	8000	4	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	2	3	5	2	1	1	3	1	1.4	35	120	58		
365	15	1	1	4000	4	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	5	2	1	1	3	2	1.6	39	110	70		
366	15	1	1	4000	5	0	0	0	0	0	0	0	0	0	0	0	0	0	3	2	3	4	3	2	2	1	2	3	1.6	41	100	80		
367	15	1	1	7000	6	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	2	4	2	2	1	3	1	1.5	37	120	80		
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369	15	1	1	8000	5	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	2	5	1	1	2	1	1	1.6	41	120	80		
370	15	1	1	6500	6	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	2	4	2	1	2	3	2	1.5	40	96	58		
371	15	1	1	8000	4	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	2	3	3	1	2	2	3	1	1.5	37	116	60		
372	15	1	1	9000	5	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	2	2	5	2	2	1	3	3	1.6	40	100	60		
373	15	1	1	8000	4	0	0	0	0																									



Sl.No	age	sex	religion	income	members	f_hyp	m_hyp	sib_hyp	f_heart	m_heart	sib_heart	f_dm	m_dm	sib_dm	f_stk	m_stk	sib_stk	frut	veg	non_veg	junk_f	veg_ood	oil	salt	go_sc	games	g_time	tv_time	ht	wt	sbp	dbp	
531	15	2	1	8000	5	0	0	0	0	0	0	0	0	0	0	0	0	0	3	2	3	3	5	2	2	2	2	4	1	1.5	38	100	70
532	15	2	1	6000	4	0	0	0	0	0	0	0	0	0	0	0	0	3	2	3	4	5	2	2	2	3	1	2	1.5	40	102	70	
533	15	2	1	6000	5	0	0	0	0	0	0	0	0	0	0	0	0	2	1	2	2	5	2	2	3	1	2	1.4	33	108	54		
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538	15	2	1	2000	4	0	0	0	0	0	0	0	0	0	0	0	0	3	2	4	3	6	2	1	4	4	3	1.5	35	120	70		
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542	15	2	1	3000	5	0	0	0	0	0	0	0	0	0	0	0	0	2	2	3	3	5	2	2	4	4	4	1.5	37	120	70		
543	15	2	1	3000	6	0	0	0	0	0	0	0	0	0	0	0	0	3	2	3	3	5	2	2	3	1	1	1.5	39	110	70		
544	15	2	1	6000	5	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	3	5	2	2	3	1	1	1.6	49	110	80		
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551	15	2	1	2500	6	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	4	5	2	1	4	4	3	1.4	34	118	60		
552	15	2	1	5000	5	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	3	3	2	2	1	2	3	1.5	35	100	60		
553	15	2	2	3500	5	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	2	4	2	2	3	1	2	1.4	33	100	70		
554	15	2	1	3000	4	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	3	5	1	1	3	1	1	1.5	39	110	70		
555	15	2	2	2500	5	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	1	4	2	1	3	1	1	1.6	42	120	70		
556	15	2	1	4000	6	0	0	0	0	0	0	1	0	0	0	0	0	3	1	3	2	4	1	1	3	1	1	1.4	51	114	88		
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558	15	2	1	4000	6	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	3	5	1	1	3	2	1	1.4	35	116	64		
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560	15	2	1	9000	5	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	3	5	2	1	2	1	1	1.5	39	110	80		
561	15	2	1	3000	4	1	0	0	0	0	0	0	0	0	0	0	0	2	2	3	3	4	1	2	3	1	1	1.4	30	110	70		
562	15	2	1	5000	5	0	0	0	0	0	0	0	0	0	0	0	0	1	1	3	2	5	2	2	2	1	1	1.5	35	100	70		
563	15	2	1	7000	4	0	0	0	0	0	0	1	0	0	0	0	0	2	1	3	3	5	1	1	2	1	1	1.6	42	120	80		
564	15	2	2	5000	3	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	3	3	2	3	4	4	4	1.5	48	108	62		
565	15	2	1	9000	4	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	2	2	1	1	3	1	1	1.5	47	108	54		
566	15	2	1	8000	4	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	3	4	1	1	1	1	1	1.4	32	94	54		
567	15	2	2	3000	7	0	0	0	0	0	0	0	0	0	0	0	0	2	1	4	3	5	2	1	3	1	1	1.5	32	112	56		
568	15	2	1	6000	4	0	0	0	0	0	0	0	0	0	0	0	0	2	1	2	2	5	2	2	4	4	3	1.5	41	106	68		
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570	15	2	1	4000	5	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	3	5	2	2	4	4	3	1.5	34	112	72		
571	15	2	1	7500	3	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	3	5	1	1	2	2	3	1.5	46	120	74		
572	15	2	1	4000	4	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	3	4	1	2	4	4	3	1.6	46	128	80		
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575	15	2	1	7500	5	0	0	0	1	0	0	0	0	0	0	0	0	2	1	3	2	5	2	2	2	2	3	1.5	55	138	74		
576	15	2	1	5000	6	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	3	5	2	2	4	4	1	1.5	35	98	54		
577	15	2	1	6000	7	0	0	0	0	0	0	1	0	0	0	0	0	3	1	3	4	4	2	2	3	2	1	1.5	45	106	68		
578	15	2	1	6000	5	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	3	5	1	2	4	4	1	1.5	37	117	76		
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580	15	2	1	4000	4	0	0	0	0	0	0	0	0	0	0	0	0	4	1	3	4	5	1	2	4	4	2	1.5	35	108	84		
581	15	2	1	10000	5	0	0	0	0	0	0	0	0	0	0	0	0	1	4	4	1	2	2	3	4	4	1	1.5	42	118	68		
582	15	2	1	20000	5	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	2	5	2	3	3	1	2	1.5	46	102	64		
583	15	2	1	7000	4	0	0	0	0	0	0	0	0	0	0	0	0	2	2	3	4	5	2	3	4	4	4	1.4	41	114	74		
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585	15	2	1	4000	5	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	3	2	5	1	2	1	3	1.4	43	114	60		
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587	15	2	1	9000	4	0	0	0	0	0	0	0	0	0	0	0	0	1	1	3	3	5	1	1	3	1	2	1.4	46	138	86		
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Sr.No	age	sex	religion	income	members	f_hyp	m_hyp	sib_hyp	f_heart	m_heart	sib_heart	f_dm	m_dm	sib_dm	f_stk	m_stk	sib_stk	friut	veg	non_veg	junk/fd	oil	salt	gooschool	games	t_time	tv_time	ht	wt	sbp	dtpb		
638	15	2	1	8000	4	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	3	4	1	1	1	1	1	1.4	32	94	70		
639	15	2	2	3000	6	0	0	0	0	0	0	0	0	0	0	0	0	2	1	4	3	5	2	1	1	1	1	1.5	32	112	68		
640	16	1	1	2000	5	0	0	0	0	0	0	0	0	0	0	0	0	2	3	3	3	2	1	2	3	2	2	1.6	57	122	82		
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642	16	1	1	10000	5	0	0	0	0	0	0	0	0	0	0	0	0	1	1	3	3	5	2	2	3	2	4	1.6	42	122	84		
643	16	1	1	10000	6	0	0	0	0	0	0	0	0	0	0	0	0	1	1	3	3	5	2	3	1	3	1	1.5	38	112	72		
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649	16	1	1	4000	6	0	0	0	0	0	0	0	0	0	0	0	0	0	3	4	3	2	4	1	2	2	3	2	1.6	52	132	62	
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652	16	1	1	3500	5	0	0	0	0	0	0	0	0	0	0	1	1	0	1	2	3	3	5	2	2	3	2	2	1.7	43	150	82	
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658	16	1	1	4000	4	1	0	0	0	0	0	0	0	0	0	0	0	0	2	1	2	5	3	2	2	1	2	2	1.6	53	118	80	
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660	16	1	2	2000	5	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	2	5	1	2	4	4	3	1.5	41	122	74	
661	16	1	1	2000	5	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	2	3	2	2	2	1	2	3	1.6	44	136	84	
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663	16	1	1	2000	4	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	4	5	2	2	1	1	1	1.6	42	110	68	
664	16	1	3	2000	5	0	0	0	0	0	0	1	0	0	0	0	0	0	2	1	3	2	5	2	1	1	2	1	1.6	40	110	60	
665	16	1	1	2000	4	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	4	4	4	2	3	1	2	1	1.5	35	122	88	
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667	16	1	1	3000	5	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3	3	2	4	3	2	2	3	1	1.6	41	156	104	
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669	16	1	1	5000	6	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	2	4	2	1	3	3	2	1.6	50	110	72	
670	16	1	1	3000	5	0	1	0	0	0	0	0	0	0	0	0	0	0	3	1	3	3	2	2	2	2	2	2	1.6	50	124	52	
671	16	1	1	2500	3	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	3	3	5	2	2	2	3	3	1.7	41	152	68	
672	16	1	2	4000	6	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	3	2	4	2	1	1	3	3	1.7	40	112	56	
673	16	1	1	2000	5	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	2	2	3	2	3	3	3	1.8	45	146	66	
674	16	1	1	2000	5	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	5	2	2	2	4	4	2	1.5	35	100	60	
675	16	1	1	2000	4	0	1	0	0	0	0	0	1	0	0	0	0	0	3	1	3	2	5	2	3	4	4	2	1.5	40	120	80	
676	16	1	1	2000	4	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	1	5	2	2	2	3	3	1	1.7	55	118	78	
677	16	1	1	3000	4	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	2	2	2	1	2	1	2	1	1.6	37	110	70	
678	16	1	3	4500	4	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	1	5	2	1	1	3	2	1.6	38	110	70	
679	16	1	1	4500	4	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	3	5	2	3	3	3	2	1.5	52	120	80	
680	16	1	1	4000	5	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	3	5	2	1	3	4	1	1.5	40	110	70	
681	16	1	1	5000	5	0	0	0	0	0	0	0	0	0	0	0	0	0	3	2	3	2	4	1	3	3	3	1	1.7	45	124	62	
682	16	1	1	2000	4	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	3	2	5	2	1	1	3	3	1.4	33	120	70
683	16	1	1	3000	6	0	0	0	0	0	0	0	0	0	0	0	0	0	3	3	4	3	5	2	3	1	1	1	1.6	45	110	90	
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685	16	1	1	6000	4	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	3	3	5	2	3	1	2	3	1.6	44	120	60	
686	16	1	1	8000	5	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	2	5	2	2	2	2	3	1.7	44	92	60	
687	16	1	1	40000	6	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2	2	3	3	2	1	2	2	1.5	39	110	70	
688	16	1	1	4500	4	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2	3	3	2	2	2	3	2	1.6	60	120	70	
689	16	1	1	5000	5	0	0	0	0	0	0	0	0	0	0	0	0	0	3	1	2	3	4	5	3	1	2	2	1	1.6	42	120	70
690	16	1	1	4000	3	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	2	3	5	2	1	1	3	4	1.5	44	90	60	
691	16	1	1	10000	8	0	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	2	5	3	1	2	3	1	1.6	60	116	80	
692	16	1	1	5000	5	0	0	0	0	0	0	0	0	0	0	0	0	0	3	2	3	3	5	2	3	2	3	1	1.7	48	110	60	
693	16	1	1	12000	6	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	3	2	2	2	1	1	2	3	1.6	42	90	70	
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Sl.No	age	sex	religion	income	members	f_hyp	m_hyp	sib_hyp	f_heart	m_heart	sib_heart	f_dm	m_dm	sib_dm	f_stk	m_stk	sib_stk	fruit	veg	non_veg	junk_f	oil	salt	go_scoo	games	g_time	tv_time	ht	wt	sbp	dbp		
745	17	1	1	15000	7	0	0	0	0	0	0	0	0	0	0	0	0	3	2	3	2	2	3	2	1	3	1	1.7	52	116	72		
746	17	1	1	2000	8	0	0	0	0	0	0	0	0	0	0	0	0	4	1	3	4	5	2	1	2	2	4	1.6	46	134	54		
747	17	1	1	3000	4	0	0	0	0	0	0	0	1	0	0	0	0	2	1	4	4	2	2	2	2	1	3	1.6	39	120	68		
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749	17	1	1	2500	6	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	3	5	1	3	3	3	2	1.7	48	108	67		
750	17	1	1	3500	4	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	2	5	2	3	3	3	1	1.7	46	131	56		
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754	17	1	1	4500	7	0	0	0	0	0	0	1	0	0	0	0	0	2	1	3	3	5	2	1	1	2	3	1.6	45	128	66		
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758	17	1	1	2000	4	0	0	0	0	0	0	0	0	0	0	0	0	2	2	4	2	2	2	1	3	1	1	1.6	40	112	64		
759	17	1	1	2000	7	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	2	5	1	2	2	2	2	1.7	51	124	51		
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766	17	1	1	3000	6	0	0	0	0	0	0	0	0	0	0	0	0	2	3	1	4	4	2	1	2	3	3	1.7	42	124	80		
767	17	1	1	4000	5	0	1	0	0	0	0	0	0	0	0	0	0	2	1	3	3	4	2	3	2	2	2	1.6	45	132	82		
768	17	1	1	2000	4	0	0	0	0	0	0	1	0	0	0	0	0	3	2	3	3	4	1	2	3	3	3	1.7	55	100	66		
769	17	1	1	2000	5	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	1	2	2	3	2	3	3	1.6	41	116	72		
770	17	1	1	5000	4	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	2	4	2	2	1	2	1	1.7	51	136	84		
771	17	1	1	4500	5	0	0	0	0	0	0	0	0	0	0	0	0	3	2	3	1	2	2	2	2	2	3	1.7	41	102	74		
772	17	1	2	2000	5	0	0	0	0	0	0	0	0	0	0	0	0	3	2	3	3	5	2	2	3	2	2	1.6	45	116	64		
773	17	1	2	2000	5	0	0	0	1	0	0	0	0	0	0	0	0	3	1	3	2	5	1	1	2	3	1	1.8	65	124	80		
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775	17	1	1	2000	7	0	0	0	0	0	0	0	0	0	0	0	0	2	3	3	4	5	1	3	4	4	1	1.6	62	124	72		
776	17	1	1	3000	5	0	0	0	0	0	0	0	0	0	0	0	0	2	1	2	1	5	2	2	1	2	1	1.6	50	126	80		
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778	17	1	1	1000	4	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	2	5	2	3	1	2	1	1.5	40	108	66		
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787	17	1	1	5000	4	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	1	5	4	2	1	1	1	1.8	55	104	74		
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789	17	1	1	2000	5	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	2	3	2	1	1	1	3	1.7	71	120	70		
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791	17	1	1	3000	5	0	0	0	0	0	0	0	0	0	0	0	0	3	2	3	3	5	2	2	2	1	4	1.6	38	120	70		
792	17	1	1	5000	4	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	1	5	3	1	1	2	3	1.6	41	110	80		
793	17	1	1	2500	4	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	3	5	2	1	4	4	3	1.6	37	110	70		
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796	17	1	1	3000	6	0	0	0	0	0	0	0	0	0	0	0	0	1	2	3	1	2	2	2	1	3	3	1.6	45	128	74		
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799	17	1	1	4000	7	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	2	5	2	3	3	2	2	1.7	45	108	58		
800	17	1	1	2500	5	0	0	0	0	0	0	0	0	0	0	0	0	3	1	2	1	5	2	2	2	2	2	1.7	45	102	64		
801	17	1	1	2000	5	0	0	0	0	0	0	0	0	0	0	0	0	1	1	3	1	4	2	2	1	1	3	1.7	40	124	64		
802	17	1	1	3000	5	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	2	2	2	3	2	2	2	1.7	49	112	58		
803	17	1	1	5000	4	0	0	0	0																								

Sl.No	age	sex	religion	income	members	f_hyp	m_hyp	sib_hyp	f_heart	m_heart	sib_heart	f_dm	m_dm	sib_dm	f_stk	m_stk	sib_stk	frut	veg	non_veg	junk_f	ood	oil	salt	go_sc	hool	games	g_time	tv_time	ht	wt	sbp	dbp
852	17	2	1	2000	6	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	4	2	5	1	1	4	4	4	3	1.5	50	110	80
853	17	2	1	2000	5	0	0	0	0	0	0	0	0	0	0	0	0	3	2	3	4	4	3	3	4	4	4	1	1.5	42	110	80	
854	17	2	1	2000	5	0	0	0	0	1	0	0	0	0	0	0	0	3	2	3	3	4	2	3	4	4	1	1.5	28	90	66		
855	17	2	1	2000	9	0	0	0	0	0	0	1	0	0	0	0	0	2	1	2	2	5	3	3	4	4	4	1	1.6	57	110	70	
856	17	2	1	2000	5	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	3	5	2	3	4	4	2	1.5	38	124	72		
857	17	2	1	2000	5	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	1	5	2	3	4	4	3	1.7	49	130	74		
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859	17	2	1	2000	6	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	5	1	3	4	4	2	1.7	40	96	72		
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863	17	2	1	2000	6	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	3	5	2	1	4	4	1	1.5	48	100	60		
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866	17	2	1	3500	4	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	3	5	2	1	4	4	3	1.6	40	110	80		
867	17	2	1	3500	4	0	0	0	0	0	0	0	0	0	0	0	0	3	2	3	4	4	5	2	4	4	1	1.5	69	130	70		
868	17	2	1	2500	3	0	0	0	0	0	0	0	0	0	0	0	0	3	2	3	4	2	2	1	4	4	1	1.5	47	120	70		
869	17	2	1	5000	5	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	1	2	1	1	4	4	1	1.4	39	132	80		
870	17	2	1	3000	5	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	1	2	2	1	4	4	1	1.5	39	110	80		
871	17	2	1	4000	5	0	0	0	0	0	0	0	1	0	0	0	0	3	1	3	3	5	2	1	4	4	1	1.5	40	100	70		
872	17	2	1	10000	5	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	3	5	2	2	4	4	1	1.5	35	92	68		
873	17	2	1	6000	4	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	1	5	2	2	4	4	1	1.5	36	104	68		
874	17	2	1	10000	5	0	0	0	1	0	0	0	1	0	0	0	0	1	1	3	1	5	2	2	4	4	1	1.5	45	106	72		
875	17	2	1	10000	6	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	3	5	2	2	4	4	1	1.6	56	112	76		
876	17	2	1	2000	6	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	3	5	2	2	4	4	2	1.6	57	136	92		
877	17	2	1	2000	5	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	3	2	3	2	4	4	2	1.5	52	138	92		
878	17	2	1	2000	7	0	0	0	0	0	0	0	1	0	0	0	0	3	1	3	3	4	2	2	4	4	2	1.6	53	108	80		
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880	17	2	1	2000	5	0	0	0	0	0	0	0	1	0	0	0	0	1	1	2	3	4	2	1	4	4	2	1.5	52	124	82		
881	17	2	1	2000	4	0	1	0	0	0	0	0	0	0	0	0	0	2	1	3	1	5	1	1	4	4	3	1.6	41	120	72		
882	17	2	2	4000	7	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	2	4	2	2	4	4	1	1.6	39	120	70		
883	17	2	1	5000	5	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	1	2	2	1	4	4	1	1.5	35	120	70		
884	17	2	1	8000	6	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	3	5	2	1	4	4	1	1.5	39	96	60		
885	17	2	1	2000	5	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	3	5	2	1	4	4	1	1.5	36	88	52		
886	17	2	1	3000	5	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	2	5	2	1	4	4	1	1.6	56	128	88		
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888	17	2	1	3000	4	0	0	0	0	0	0	0	1	0	0	0	0	3	1	3	4	5	2	1	4	4	1	1.5	41	110	68		
889	17	2	1	10000	5	0	0	0	0	0	0	0	0	0	0	0	0	2	2	4	1	5	2	2	4	4	3	1.5	42	110	62		
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891	17	2	1	3000	6	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	2	4	1	2	4	4	2	1.5	46	112	80		
892	17	2	1	4500	3	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	3	2	1	2	4	4	2	1.6	40	96	72		
893	17	2	1	7000	3	0	0	0	0	0	0	0	1	0	0	0	0	3	1	3	2	4	2	3	4	4	2	1.5	48	100	60		
894	17	2	1	5000	6	0	0	0	0	0	0	0	0	0	0	0	0	2	2	4	2	5	1	1	4	4	3	1.5	50	110	80		
895	17	2	1	4500	5	0	0	0	0	0	0	0	0	0	0	0	0	3	2	3	4	4	3	3	4	4	1	1.5	42	110	80		
896	17	2	1	6000	5	0	0	0	0	1	0	0	0	0	0	0	0	3	2	3	3	4	2	3	4	4	1	1.5	28	90	66		
897	17	2	1	7000	9	0	0	0	0	0	0	0	1	0	0	0	0	2	1	2	2	5	3	3	4	4	1	1.6	57	110	70		
898	17	2	1	3500	5	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	3	5	2	3	4	4	2	1.5	38	124	72		
899	17	2	1	7500	5	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	1	5	2	3	4	4	3	1.7	49	110	74		
900	17	2	1	5000	3	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	1	5	2	2	4	4	1	1.6	61	110	78		
901	17	2	1	7000	6	0	0	0	0	0	0	0	0	0	0	0	0	2	2	2	2	5	1	3	4	4	2	1.7	40	96	72		
902	17	2	1	12000	6	0	0	0	0	0	0	0	0	0	0	0	0	2	3	3	2	5	1	3	4	4	2	1.6	39	104	76		
903	17	2	1	4000	5	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	3	2	1	2	4	4	2	1.5	40	120	70		
904	17	2	1	3500	4	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	2	4	1	2	4	4	2	1.6	45	108	76		
905	17	2	1	8500	6	0	0	0	0	0	0	0	0	0	0	0	0	2	1	3	3	5	2	1	4	4	1	1.5	48	100	60		
906	17	2	1	4000	5	0	0	0	0	0	0	0	0	0	0	0	0	3	3	3	2	5	1	3	4	4	1	1.5	30	90	60		
907	17	2	1	8000	6	0	0	0	0	0	0	0	0	0	0	0	0	3	1	4	3	5	2	1	4	4	1	1.5	42	110	80		
908	17	2	1	3500	4	0	0	0	0	0	0	0	0	0	0	0	0	3	1	3	3	5	2	1	4	4	3	1.6					

**INSTITUTIONAL ETHICS COMMITTEE**  
**MADRAS MEDICAL COLLEGE, CHENNAI -3**

Telephone No: 044 25305301

Fax: 044 25363970

**CERTIFICATE OF APPROVAL**

The Institutional Ethics committee of Madras Medical College, reviewed and discussed your application for approval of the proposal entitled "A cross sectional study on the prevalence of hypertension among school students aged 14 to 17 years in rural areas of Kancheepuram District, Tamilnadu 2011" No. 15082011

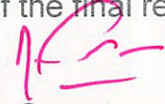
The following members of Ethics Committee were present in the meeting held on 16.08.2011 conducted at Madras Medical College, Chennai -3.

- |  |                     |
|--|---------------------|
| 1. Prof. S.K. Rajan. MD  | -- Chairperson      |
| 2. Dr. V. Kanagasabai MD<br>Dean, Madras Medical College, Chennai -3           | -- Deputy Chairman  |
| 3. Pro. A. Sundaram MD<br>Vice Principal, Madras Medical College, Ch -3        | -- Member Secretary |
| 4. Prof. R. Sathianathan MD  | -- Member           |
| 5. Prof. R. Nandhini MD<br>Director, Institute of Pharmacology ,MMC, Ch-3      | -- Member           |
| 6. Prof. C. Rajendiran, MD<br>Director , Inst. Of Internal Medicine, MMC, Ch-3 | -- Member           |
| 7. Thiru. A. Ulaganathan<br>Administrative Officer, MMC, Ch-3                  | --- Layperson       |
| 8. Thiru. S. Govindsamy. BA BL   | -- Lawyer           |
| 9. Tmt. Arnold soulina MA  | -- Social Scientist |

We approve the proposal to be conducted in its presented form.

Sd/ chairman & Other Members

The Institutional Ethics Committee expects to be informed about the progress of the study, and SAE occurring in the course of the study, any changes in the protocol and patients information / informed consent and asks to be provided a copy of the final report.

  
Member Secretary, Ethics Committee

**A CROSS SECTIONAL STUDY ON THE PREVALENCE OF HYPERTENSION  
AMONG SCHOOL STUDENTS AGED 14 TO 17 YEARS IN RURAL AREAS OF  
KANCHEEPURAM DISTRICT, TAMIL NADU, 2011**

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**ABSTRACT**

**Background:** Hypertension which affects more than one billion people worldwide is known to have its origin in childhood. Children and adolescents with high blood pressure tend to maintain those levels of blood pressure in adulthood. But as the symptoms of hypertension in them are largely nonspecific, they are mostly undiagnosed.

**Objectives:** To assess the prevalence of hypertension among school students aged 14 to 17 years in rural areas of Kancheepuram district and also to identify the risk factors for hypertension such as obesity, family history, diet pattern and physical activity among them.

**Materials and Methods:** A cross sectional school based study was done among 934 students aged 14-17 years studying Class IX to Class XII in selected four schools of Kancheepuram district. The study was done during March to November, 2011. A pre tested questionnaire was used to collect information regarding the socio demographic details, diet pattern and physical activity. Height, weight and blood pressure were measured. Chi-Square test was used for statistical analysis.

**Results:** Among the study group 67 (7.17%) were identified as hypertensives. Prevalence among boys was 7.2% and in girls it was 7.14%. Of the hypertensives 43.28% were found to have Isolated Systolic Hypertension and 31.34% were having Isolated Diastolic Hypertension. The mean SBP and DBP were found to be 111.96 mmHg and 69.76 mmHg respectively. Among the study population 124 (13.28%) were found to be overweight/ obese. There was a significant positive correlation between SBP and DBP with age, height, weight and BMI in the study. Family history ( $P=0.03$ ) and overweight/obesity ( $P<0.001$ ) were found to be significant risk factors for hypertension in the study population.

**Conclusion:** From the study results it was seen that hypertension is prevalent among adolescents even in rural areas. This requires urgent attention failing which the burden of hypertension in adolescents will result in serious consequences such as increased incidence of cardiovascular diseases when they become adults.

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**Keywords:** Hypertension, blood pressure, adolescents, prevalence, risk factors, obesity, family history.